Specialized Oil Publications of
THE GULF PUBLISHING COMPANY
Box 2608, Houston (1), Texas

WORLD OIL and The COMPOSITE CATALOG
for the drilling-producing-pipe line industry

PETROLEUM REFINER and The REFINERY CATALOG
for the refining-natural gasoline industry

RAY L. DUDLEY, *President, Publisher*
A. L. BURNS, *General Manager*

EDITORIAL STAFF

WARREN L. BAKER, *Editor*
L. J. LOGAN, *Associate Editor*
ELTON STERRETT, *Engineering Editor*
GEORGE O. IVES; AL REESE; J. E. KASTROP; CECIL SMITH; MARY E. POOLE; KATHRYN CROUCH; ELSIE J. HIGGINS
3301 Buffalo Drive, Houston 6, Texas

DISTRICT EDITORS

HENRY OZANNE
250 Park Ave.
New York 17, N. Y.

GILBERT M. WILSON
W. W. Wilson Bldg.
Huntington Park, Calif.

ANTHONY GIBBON
Hunt Bldg.
Tulsa 3, Okla.

E. N. TIRATSOO
62 Redcliffe Square,
SW 10, London

ADVERTISING STAFF

TOM W. NELSON, *Advertising Manager*
RANDALL BROOKS, *Assistant Advertising Manager*

NELSON BIGELOW
FRANK VICKREY
250 Park Ave.
New York 17, N. Y.

ROGER MOTHERAL
1010 Euclid Ave.
Cleveland 15, Ohio

H. G. FITZPATRICK
332 S. Michigan Ave.
Chicago 4, Ill.

BILL ATCHESON
Hunt Bldg.
Tulsa 3, Okla.

J. W. CURTS
W. W. Wilson Bldg.
Huntington Park, Calif.

CHARLES WYATT
3301 Buffalo Drive
Houston 6, Texas

CIRCULATION DEPARTMENT

CLINTON S. QUIN, JR., *Manager*

Published every month. Single copies 50 cents (except special issues). Subscription price: domestic and foreign, $2 a year; 2 years, $3; 3 years, $4. Advertising rates on application.
Copyright 1947 by The Gulf Publishing Company.

Hire man for $2 a year?

Sounds foolish, yet for $2 a year (subscription to WORLD OIL) you can have a group of experts working to keep you up-to-date on improvements and developments in oil operations not only in the U. S. but all over the world. Check personal order form, Page 356.

WORLD OIL

Established 1916 as THE OIL WEEKLY

CONTENTS

October, 1947 **Vol. 127, No. 6**

NEWS ANALYSIS SECTION

We've Long Wanted to Do This — *Ray L. Dudley* — 39
The Changing Panorama — 41
Monthly News Analysis — 43
Looking Ahead — 50
Advertisers' Index — 36

CURRENT OUTLOOK SECTION

Permian Basin Area—Bright Spot in U. S. Oil Picture — *H. H. King* — 53
Petroleum Steel Needs Up Sharply — *Warren L. Baker* — 60
Drilling Contracting Situation — *Ray L. Dudley* — 63
Vigorous Refinery Expansion Needed — *L. J. Logan* — 66
Oklahoma Shows the Way — *Anthony Gibbon* — 70
Further Difficulty in Meeting Demand Is Forecast — 74
Petroleum Trends—Production and Refining at New Highs in August — 76
Completions Drop but Top Year's Average — 78
Exploration 12 Percent Ahead of Last Year — 79

DRILLING SECTION

Source and Use of Diamonds in Oil and Gas Well Coring — *Carroll Deely* — 87
Pressure Welding — *A. L. Burns, Jr.* — 92
Special Trailer Speeds Derrick Moves — *Elton Sterrett* — 100
New Indentation Method Determines Equipment Wear — 104
Boats Serve as Mud Pits for Workover Rig — *H. M. Pearce* — 112
Mobile Rotary Rig for Rat Hole Drilling — *John C. Albright* — 119
How to Do It—Drilling Hints — 125
Newer Techniques in Aerial Surveying (Fourth of Five Parts) — *Sherman A. Wengerd* — 136

PRODUCTION SECTION

Transparent Model of Reservoir Showing Displacement of Oil by Conjoint Use of Gas and Water — *Frederick Squires* — 145
Inhibiting Subsurface Sulfide Corrosion — *Dr. P. L. Menaul* — 150
Heating High-Pressure Gas Flow Lines to Eliminate Freezing at the Regulator — *J. E. Kastrop* — 157
Bottom-Hole Separator Conserves Reservoir Energy — *Kork Kelley* — 163
Secondary Recovery in the Rocky Mountains — *Nat A. Slagter* — 170
Condensate Production and Cycling (Ninth of a Series) — *Park J. Jones* — 174
Electric Power in Water-Flooding — *B. F. Thompson* — 181
How to Do It—Production Hints — 186

PIPE LINE SECTION

Meeting Gas Peak Delivery in the Appalachian Area — *H. J. Wagner* — 195
Electrical Equipment for Oil Pipe Line Pumping Stations — *W. G. Taylor* — 199
Deep Rock Oil Corporation's Pipe Line System (35th of a Series) — 216
Mississippi River Fuel Corporation's Pipe Line System (36th of a Series) — 217
Pipe Line Construction News — 218
How to Do It—Pipe Line Hints — 221

INTERNATIONAL SECTION

TAPline — *Henry Ozanne* — 229
Pictorial Visit to Iran — 232
U. S. Independents and Foreign Oil — *Henry Ozanne* — 236
American Independent Operating Plans Vague — 239
Western Canada Oil Boom — *C. O. Nickle* — 242
Macmillan Plans to Test Holdings in Sicily — 249
Russia Combats Declining Production in Baku Fields — 250
Second Oil Well in Chile's Springhill Field — 252
Mexico Pushes Expansion of Oil Operations — 254
Peru's President Asks Liberal Oil Policy — 257
The Tanker Fleet of Petroleos Mexicanos — 258
Geophysical Exploration in India — *E. N. Tiratsoo* — 263
Oil in the New India — 267

WEST TEXAS SECTION

Geological Data and Development History of Permian Basin Oil Fields — *H. H. King and Gilbert M. Wilson* — 271

OTHER DEPARTMENTS

Oil Man's Calendar — 185
New Equipment and Literature — 335
Men in the Industry News — 351
Manufacturers'—Suppliers' Notes — 364
Squeaks from the Bull Wheel — 378

ADVERTISERS' INDEX

* Asterisk preceding name of advertiser indicates that detailed data on products and services of the firm will be found in current 15th (1946-47) edition of The Composite Catalog of Oil Field and Pipe Line Equipment.

*A-1 Bit and Tool Co. 266
*Acme Fishing Tool Co. 352
Affiliated National Hotels 350
*American Cable Division
American Chain & Cable Co. II Cover
American Cyanamid Co. 323
*American Iron & Machine Works Co. 93
American Manufacturing Co. of Texas 187
*American Meter Co. 328
American Petroleum Institute 11
*American Roller Bearing Co. 348
*American Sand-Banum Co. 372
American Steel & Wire Co. 25
*Atlas Engineering Works 23
Avondale Marine Ways, Inc. 372
*Axelson Manufacturing Co. 32

*B & W Inc. 358
*Baash-Ross Tool Co. 237
*Baker Oil Tools, Inc. 40, 130, 189 and 264-265
*Baldwin-Duckworth Division
Chain Belt Co. 99
*Baroid Sales Division
National Lead Co. 262 and 293
William M. Barret, Inc. 380
Beaumont Well Works Co. 378
*Bethlehem Steel Co. 45 and 307
*Bethlehem Supply Co. 19
*Black, Sivalls & Bryson, Inc. 20
The Boyaird Supply Co. 201
*S. R. Bowen Co. 256
*Bowen Company of Texas 349
*The Brewster Co. 48-49
Al Buchanan Drilling Co. 317
Briggs & Stratton Corp. 354
*Bucyrus-Erie Co. 309
*The Buda Co. 359
Burch Agate Torpedo 314
J. J. Burris 345
*Byron Jackson Co. 52

Cable & Stine 190
*Cameron Iron Works, Inc. 67 and 85
*Cardwell Manufacturing Co. 64-65
*Caterpillar Tractor Co. 194
*The Cavins Corp. 360
Century Geophysical Co. 68-69
*Chain Belt Co. 89 and 99
*Chicago Pneumatic Tool Co. 371
Christensen Diamond Products Co. 382
The City National Bank of Houston 329
Dan L. Clark Drilling Co. 346
*Clark Bros. Co. 206-207
Climax Molybdenum Co. 124
*The Colorado Fuel and Iron Corp. 22
Columbia Steel Co. 25
*Construction Machinery Companies 224
*Continental Motors Corp. 281
Continental Oil Co. 313
The Continental Supply Co. 210-211
*Fred E. Cooper, Inc. 179
*The Cooper-Bessemer Corp. 284-285
*Crane Co. 55
Crowell & Steele, Inc. 380
*Cummins Engine Co. 283
W. H. Curtin & Co. 226

*Detroit Diesel Engine Division
General Motors Corp. 2
*Diamond Chain Co., Inc. 311
Dowell Incoroporated 38
*Dresser Industries, Inc. 149, 180, 206-207
Drilling Specialties Co. 167
Dunigan Tool & Supply Co. 297
*E. I. du Pont de Nemours & Co. 18 and 357
*Durbin-Durco, Inc. 372
Dynamatic Corp. Insert Opp. 287

The Eagle-Picher Co. 326
*Eastman Oil Well Survey Co. 141
Eaton Manufacturing Co. Insert Opp. 286
*Economy Electric Lantern Co. 378
*E. H. Edwards Co. 319
*Emerol Manufacturing Co. 347
Empire Trust Co. 330
*Everlasting Valve Co. 361

*Fairbanks, Morse & Co. 26
*Falcon Products, Inc. 362
The First National Bank & Trust Co. 318
Florida Pipeline Project 214-215
Ft. Worth Laboratories 380
Frost National Bank of San Antonio 333
Funk Manufacturing Co. 358

*Gardner-Denver Co. 6
*The Garlock Packing Co. 350
Garrett Oil Tools 381
*Gase Pump & Burner Manufacturing Co. 193
The Gates Rubber Co. 37
General American Transportation Corp. 80
General Electric Co. 139
*General Motors Corp. 2 and 331
The Geolograph Co. 347
George Engine Co. 356
*Goodall Rubber Company of Texas 238
*H. P. Gott Manufacturing Co. 366
*Grant Oil Tool Co. 337
*Gray Tool Co. 231
*The Guiberson Corp. 269
Gulf Engineering Co. 366
Gulf Oil Corp. 367
*The Gulf Publishing Co. 302

H & M Pipe Beveling Machine Co. 226
*Halliburton Oil Well Cementing Co. III Cover
Harley Sales Co. 223
*Herb J. Hawthorne 368
*Hazard Wire Rope Division
American Chain & Cable Co. 121
*Helicoid Gage Division
American Chain & Cable Co. 287
*Hercules Tool Co. 190
Hewitt Rubber of Buffalo
Division of Hewitt-Robins Inc. 30
*Hinderliter Tool Company Division
H. K. Porter Co. 42
Homelite Corp. 308
J. R. Horrigan Construction Co. 269
Houston Laboratories 380
Houston Lighting & Power Co. Insert Opp. 17
J. M. Huber Corp. 374
*Hughes Tool Co. I Cover, 227, 228
Humble Oil & Refining Co. 321
*Hunt Tool Co. 118
Hyatt Bearings Division
General Motors Corp. 331

Independent Exploration Co. 343
Industrial Chemicals Division
American Cyanamid Co. 323
*Ingersoll-Rand Co. 373
*International Harvester Co. 59 and 175
The International Nickel Co. 156
International Petroleum Exposition 219
Iverson Tool Co. 310

J. P. Machine & Tool Co. 129
*The Jeffrey Manufacturing Co. 253
W. P. Jenny 380
*Jensen Brothers Manufacturing Co. 165
*Johns-Manville 225
*S. M. Jones Co. 153
Jones & Laughlin Steel Corp. 34
Jones & Laughlin Supply Co. 289
Earle M. Jorgensen Co. 10

Keuffel & Esser Co. 333
Keystone Development Co. Insert Opp. 16
*King Oil Tools 223
*Kobe, Inc. 149

*L & H Machine Works 345
Landis Machine Co. 353
*Lane-Wells Company 86, 244 and 380
*Larkin Packer Co. 117 and 184
Hotel Last Frontier 358
Latex Construction Co. 220
*The Thomas Laughlin Co. 222
*The Layne and Bowler Co. 339
Lee Construction Co. 243
*LeRoi Co. 191
*A. Leschen & Sons Rope Co. 109
*Line Scale Co. 130
*Link-Belt Co. 1 and 127
Lone Star Cement Corp. 47
*The Lufkin Foundry & Machine Co. 21
The Lufkin Rule Co. 332

M & H Valve & Fittings Co. 338
*Magnet Cove Barium Corp. 13
*Jas. P. Marsh Corp. 251
*Martin-Decker Corp. 327
Mayes Bros. 205
The Mayo Hotel 364
*McCullough Tool Co. 379
Mid-Continent Petroleum Corp. 57
*Mid-Continent Supply Co. 295
*Miller Sand Pump Co. 189
*Mission Manufacturing Co. Insert 160-161
*Lee C. Moore Corp. 95

Murray Rubber Co. 277
National Geophysical Co. 273
*National Lead Co. 262 and 293
*The National Supply Co. 114-115
National Tube Co. 301
New Bedford Cordage Co. 351
Nichols Tool Co. 134
*Nordstrom Valve Division
Rockwell Manufacturing Co. 33
*W. C. Norris Manufacturer, Inc. 260
Norvell-Wilder Supply Co. 97

*Oil Center Tool Co. 241
*Oil Well Mfg. Corp. 31
*Oil Well Supply Co. 113 and 169
*D. W. Onan & Sons, Inc. 322
*Orbit Valve Co. 82-83
*Otis Pressure Control, Inc. 162

*Pacific Pumps, Inc. 173
Paddock Engineering Co. of Texas 344
Pan American Airways, Inc. 332
Paramount Supply Co. 226
*The Parkersburg Rig & Reel Co. 177 and 279
*Patterson-Ballagh Division
Byron Jackson Co. 71, 159, 378
Pelican Well Tool & Supply Co. 363
*Penberthy Injector Co. 126, 188, 336
Petroleum Electric Power Association 202-203
Petty Geophysical Engineering Co. 259
Pioneer Air Lines 351
*H. K. Porter Co. 42

*J. P. Ratigan, Inc. 355
*Rector Well Equipment Co. 298-299
*Reed Roller Bit Co. 51 and 122-123
*Regan Forge & Engineering Co. 128
Republic National Bank of Dallas 312
Republic Steel Corp. 105
*Republic Supply Co. 4-5
*The Ridge Tool Co. 345, 347 and 349
Robins Conveyors Incorporated
Division of Hewitt-Robins, Inc. 30
*Rockwell Manufacturing Co. 33
*Rollway Bearing Co. 315

*S-K-F Industries, Inc. 8
Sampson Machinery & Supply Co. 17
*Schlumberger "Surenco" 235
The Second National Bank of Houston 369
Seismograph Service Corp. 255
*Shaffer Tool Works 274-275
Sheffield Steel Corp. 334
Shell Development Co. 375
Shreveport Geological Society 370
*Nowery J. Smith Co. 366
Southern Engine & Pump Co. 333
*Southern Mill & Manufacturing Co. 14
Southwest Equipment Co. 342
*Spang & Co. 340
*Sperry-Sun Well Surveying Co. 135
Standard Oil Company of California 24
*Standco Brake Lining Co. 380
Stanolind Oil & Gas Co. 154
*Sterling Machinery Corp. 134
*Sterling Packing & Gasket Co. 15
*Stewart & Stevenson Services, Inc. 248

Tellepsen Construction Co. 27
*Templeton, Kenly & Co. 130
Texas Electric Steel Casting Co. 103
*Texas Iron Works 365
*The Thermoid Co. 131
*Thompson Tool Co. 324
*Thornhill-Craver Co. 7
The Torrington Co. 28
Trading Post Section 376
*Tretolite Co. 143
Tube-Kote 9

Union Tank & Supply Co. 247
*Unit Rig & Equipment Co. 111
*United States Rubber Co. 325
United States Steel Corp. 25, 113, 169, 301
United States Steel Export Co. 25, 301
*Universal Atlas Cement Co. 270

*Victaulic Company of America 192
*Visco Products Co. 3

*W-K-M Company, Inc. 183
Walter Motor Truck Co. 16
War Assets Administration 12
*Warren Automatic Tool Co. 320
*Waukesha Motor Co. 341
*Weatherford Spring Co. 91
*Welderz-Frend Generator Co. 134
*Well Equipment Mfg. Corp. 132 and 133
*Wheeling Machine Products Co. 366
*The Wheland Co. 29
David White Co. 364
*Wickwire Spencer Steel Division
The Colorado Fuel and Iron Corp. 22
K. R. Wilson 377
*Wilson Manufacturing Co. 106-107
*Wilson Supply Co. 290-291
*Wisconsin Motor Corp. 316
Wood Conversion Co. 349
*Worthington Pump &
Machinery Corp. 171 and 213
Wyatt Metal & Boiler Works IV Cover

*Young Engine Corp. 305
The Youngstown Sheet & Tube Co. 144

WE'VE LONG WANTED TO DO THIS

By RAY L. DUDLEY, Publisher

WITH this issue, WORLD OIL becomes a monthly publication, and thereby hangs a tale! (An annual Yearbook-Forecast Number will constitute a thirteenth issue.)

As many of our readers know, it has been the practice of our editors to get together in Houston at least once a year and plan the outline of our editorial effort for the following year or six months. At such conferences, two things almost invariably have occurred:

The publisher, who started out as editor of the publication back in 1916, would say to the editorial staff that no oil publication, including our own, was living up to its opportunity, that at best none of us was doing more than making a dent in our possibilities. And then, at some time or other during the conference, the editor would say that to do a better job he had to have more editorial pages.

Now, with a monthly publication, and a generous allocation of space per issue to the editor, and a staff more than adequate to do a splendid editorial job, the goal of both the publisher and the editor (actually the goals are one and the same) will have a much better chance of attainment.

It is not our intention to make WORLD OIL a strictly technical publication. While each issue will contain a large number of pages devoted to technical articles, dealing with all phases of exploration, drilling, production and pipe line work, a very important feature of WORLD OIL in the future will be special articles dealing with important subjects on which the research will be altogether out of line as compared with the space required for presentation. For instance, right now, we are working on two articles, each of which will require close to a month's time on the part of a staff man, but the finished articles will run only about two pages each.

As a matter of policy WORLD OIL is being "sectionalized," in order to keep the best possible balance between subjects of interest to our readers.

In its handling of domestic news WORLD OIL will not attempt a monthly digest, but will present a feature analyzing the *effect* of the important news developments each month.

Our readers have witnessed the change from the days when the only authentic oil *news* was that published in oil papers. Today, we must frankly admit that the oil pages of daily newspapers in every important oil center are doing exceptionally well the job which a score or more years ago was done only by weekly oil papers. The special scouting report services, known in the industry as "hot shot services," too, have been doing an excellent job. In fact, we have found that few oil men now depend on their weekly oil magazines for the spot news for which they formerly were indispensable.

The trend of the times must be recognized and we feel that there is no better time to recognize such changes than during a period when the success of our organization's effort is apparent to anyone who reads.

WORLD OIL started from a very small beginning back in 1916 as *The Gulf Coast Oil News*, the name changing shortly thereafter to THE OIL WEEKLY. In its early days it had to substitute enthusiasm for almost every other necessary factor in the publishing business. Now we come to the beginning of what we term our real job with undreamed of facilities at our command.

In the first place we have the advantage of 31 years in the business, 31 years of association with oil men, 31 years of friends made throughout the four corners of the globe. We approach our real job with not simply 31 years of experience in oil publication work, but actually an accumulation of more than 126 years on the part of its editorial staff alone.

And the enthusiasm which has been an outstanding characteristic of the staff is unabated!

This editorial staff will number 16 fulltime persons, but its work will be augmented by a continuation of the contributions of men of standing in the various phases of the oil industry. As a matter of fact it is our plan to carry more technical and operating articles from such men in the future, using our staff for research and writing of special articles.

We also approach our real job with better physical facilities than we had ever hoped to have, including a library about which you will be hearing more and more in the future. We have recently expanded our editorial offices in Houston through the completion of an addition to our main building, designed solely as editorial headquarters. We do not believe that we are immodest when we say that there are few business publications with such complete office facilities as are enjoyed by our staff.

Too, we have an advantage sadly missing 31 years ago, in a modern printing plant whose personnel has been trained especially in the handling of our publications, a plant originally designed to print THE OIL WEEKLY, but which later grew into one of the large plants of the nation.

But of all the advantages which we feel we have, we put at the top the friends made through honest effort to publish an oil paper with fair-dealing and accuracy as the principles guiding it, these principles coupled with a willingness to stick our neck out on controversial subjects when we felt we were right!

We believe that our readers are going to like the monthly WORLD OIL even better than they liked the weekly WORLD OIL and THE OIL WEEKLY before it. Certainly there is no reason now why we should not publish the kind of oil paper that it has always been our ambition to publish.

Now...more efficient than ever...

THE BAKER MODEL "K" CEMENT RETAINER

EQUIPPED WITH

THE BAKER JUNK PUSHER

which pushes junk or debris down the hole ahead of the Retainer, and greatly minimizes the hazard of premature tripping of the Retainer by the fouling of the slips.

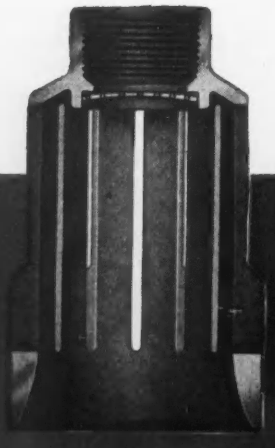
Use of the BAKER JUNK PUSHER (Product No. 403) assures greater safety and more successful results in . . .

• ***Re-Cementing*** • ***Squeeze Cementing*** • ***Cementing behind sections of pipe*** • ***Testing upper cased formations*** • ***Reducing gas/oil ratios*** • ***Cementing bad pipe*** • ***Plugging off bottom fluids*** • ***Cementing off to perforate for production*** • ***Cementing low pressure zones.***

EASY DRILLABILITY

Baker MAGNESIUM ALLOY Type Cement Retainers are readily drilled up by using drill pipe, tubing, or cable tools, since all large parts are made of magnesium except the nitricastiron slips which are easily broken up. Magnesium Retainers have ample strength to withstand any pressure which can be imposed safely upon the casing or liner. Although Baker MAGNESIUM ALLOY Type Cement Retainers are satisfactory for *temporary* bridge plugs, they may be affected by well fluids, and the CAST IRON Type is recommended for *permanent* bridge plug installations.

The Baker Junk Pusher has an outside diameter slightly smaller than the inside diameter of the casing in which the Retainer is run. All debris tends to collect in the Junk Pusher. Slots permit passage of displaced fluid, but prevent passage of junk or debris which might foul the slips and result in premature tripping of the Retainer. The internal Screen (held in place by friction) prevents debris from entering the body of the Retainer, and is blown out at the proper time by the Tripping Ball Seat.



BAKER
OIL TOOLS, INC.

Houston - Los Angeles - New York

The Changing Panorama

What Makes the Oil Industry Tick?

IT TAKES ideas, men, money and equipment to make the oil industry go. Ideas without men to put them into effect have little value. Men without ideas or the money to push them are futile. In an industry such as the oil industry the equipment used by these men, bought with the capital of the industry to carry out the ideas put forward, is of course a prime essential.

Which is another way of saying that in a publication such as WORLD OIL, the subscriber frequently finds that the advertising pages are as valuable to him as the editorial pages. In this issue there are in excess of 230 pages of advertising, offering and describing almost every kind of equipment and service used by the oil industry in exploration, drilling, producing and pipe line work. Some of these advertisements offer brand-new ways of doing things; others offer detailed information on useful equipment or service; some discuss new applications of old equipment. Practically all of them contain something of interest to the reader. They are as vital to the oil man's business as a discussion of a new drilling or production method.

No Monopoly Held On Demand Problem

THE oil-producing industry is not alone in experiencing difficulty in supplying public demand. The natural and manufactured gas and the coal industries similarly face potential demand that will be hard to satisfy this winter.

Fortunately for the public and for the industries themselves, the strong demand for all fuels is not dulling competition among these fuel-supplying industries. It is not difficult to foresee for the relatively early future the elimination of scarcities and sellers' markets. In preparation for that time, the wise industry and company must be imbued even today with a keenly competitive spirit and be holding and winning customer good will. The oil and gas industries appear to realize this fully and are conscientiously doing everything possible to satisfy demand and prevent inconveniences. Even the coal industry, in spite of former interruptions of production, has settled down to a comparatively efficient basis of operations auguring favorably for consumers.

While the fuel-supplying industries are doing their part to supply the consuming public, they nevertheless need and must have the cooperation of the consumers in using all fuels as economically and efficiently as possible. Although it is hoped that all essential requirements can be met, the nation cannot afford at present any waste of the supplies available.

The natural resources committee of the Chamber of Commerce of the U. S. headed by Dechard A. Hulcy, president of Lone Star Gas Company, recently reported that the nation's overall supply of fuel would be adequate for the coming winter, barring abnormal weather, strikes, transportation tieups, or other adverse developments. The report was prepared in cooperation with representatives of the coal, petroleum, and natural gas industries. Local shortages might occur, due to transportation difficulties, it conceded, but they will be of short duration.

With adequate transportation and with labor working reasonable hours, the coal industry can supply not only all the domestic demand for coal but also the present abnormal requirements for Europe, the report stated. Demand exists for coal of certain kinds and sizes in excess of the supply available at the point of consumption, due to strikes and so-called mourning periods and vacations of 1946 and 1947. Both household and industrial coal consumers are advised not to wait for winter to put in their coal supplies, and it is suggested that if they cannot get the exact type and kind of coal they want, they should accept the next best coal that is available. Working hours in the mines were reduced 16 percent under the present union contract, and operators are seeking to sustain production by taking on additional men. But railroad car shortage interferes with production at the mines as well as delivery and may cause local and temporary scarcities.

Drilling Contractors In Unenviable Spot

ON PAGE 63 of this issue appears an article on the drilling contracting situation. Figures from reliable sources are used in it, and the conclusion is drawn that with heavy increases in the contractor's costs and practically no increase in his price per foot (some exceptions in the deeper areas) the drilling contractor is in a very unenviable position.

This is a matter of genuine concern to the oil business generally because the trend has been steadily towards drilling by the contractor, rather than by the drilling department of an oil company. The point is made that it is to the industry's best interests that the drilling contracting arm of the oil producing business be maintained in a healthy position. The point is also made that with the increases which have been noted in the price of oil, an oil company certainly can afford to pay the contractor's costs plus a reasonable profit.

The trouble seems to be largely within the ranks of the contractors themselves in that some of them will take jobs knowing that they probably will suffer losses on them. There is no cure for this except a sound cost accounting system and guts to charge a fair price. No one has ever accused a drilling contractor of being lacking in courage, so the trouble must lie in faulty knowledge of costs or a lack of judgment in applying them practically to a business enterprise.

From the oil industry's standpoint, one of the bad effects of the contracting industry's operating at no profit could be a letdown in the use of the most efficient equipment and in the maintenance of the drilling rig. Thus far, we have heard of only a few instances of the contractor's stretching his equipment beyond safe bounds. But no contractor can long keep his rigs in first-class condition and take advantage of new ideas in time-saving equipment if he doesn't have the money to spend on them.

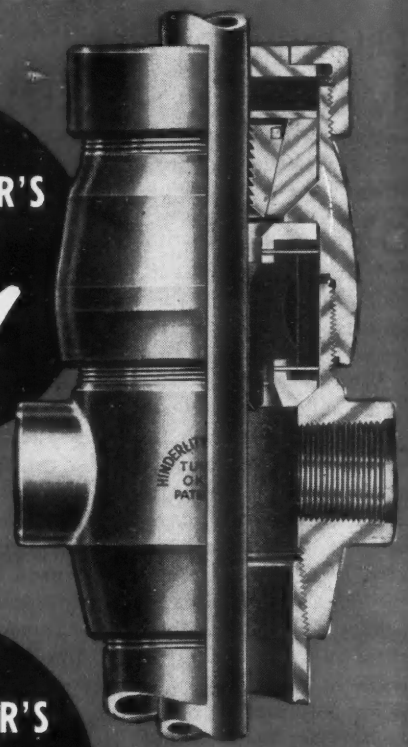
HINDERLITER

"Better Built" TUBING HEADS

EVERYTHING YOU HAVE WANTED IN A TUBING HEAD:

1. Forged steel construction throughout.
2. Steel-reinforced, 2-piece, stripper rubber—permitting free passage of tubing and collars.
3. Split auxiliary packing and slips for quick and easy installation.
4. Full-opening body for passing tools or packers.
5. Two-way convertibility—easily changed from flowing to pumping well conditions.
6. Neoprene rubber packing—oil and gas resistant for long life.
7. 4,000 pound test (AWHEM standards)—with high safety factor.
8. Precision-machined threads—API pipe sizes.
9. Double inspected before shipment.
10. Stocked by all leading supply stores.

HINDERLITER'S FAMOUS 4 in 1



HINDERLITER'S FAMOUS 2 in 1

Universal acceptance and widespread usage has made HINDERLITER Tubing Heads *Standard Equipment Throughout The Oil Country.*

HINDERLITER PORTER "Better Built" EQUIPMENT

HINDERLITER TOOL COMPANY Division

H. K. PORTER COMPANY, Inc.

Tulsa, Oklahoma — Pittsburgh, Pennsylvania

SALES OFFICES AND WAREHOUSES

Alice, Texas
Casper, Wyoming
*Clay City, Illinois
Fort Worth, Texas
*Great Bend, Kansas
Greggton, Texas
*Houston, Texas
*New Iberia, Louisiana
*Odessa, Texas
*Seminole, Oklahoma
Wichita Falls, Texas

*Complete facilities for installation of tool joints on new or used drill pipe.

Tool Joints, Rotary Subs, Rotary and Cable Drilling and Fishing Tools, Well Head Equipment, Blowout Preventers, Christmas Trees, Oil Field Specialties

MONTHLY NEWS ANALYSIS

Industry heads for disputes with federal government . . . Tidelands ownership matter far from settled . . . Hold-the-line price policy gains strength . . . Pipe for Saudi-Arabia assured . . . Exports of tubular goods gain sharply

MANY of the events of the past month fitted into a pattern which makes it increasingly evident that the industry is on the threshold of a series of disputes with the federal government. The questions involved will range from the nation's supply of oil, monopolistic practices, price fixing, tidelands ownership, steel exports, to regulation of natural gas production and gathering.

Industry Faces Series of Government Investigations

Events during the month indicate that the difficulties being experienced in providing enough petroleum to meet soaring consumption are to result in the industry being drawn into the forthcoming presidential political campaign. A series of grand jury probes, congressional committee investigations and even anti-trust suits are in store for oil men, with all tuned to get the political votes of labor and small business.

It now definitely is known that the Truman administration has plans for a big trust-busting program, based on both price-fixing and monopolistic practices by industry. Trust suits filed so far (steel, tires and movie technicolor) are but mere starters. The program will reach its height in late spring, just before the 1948 political conventions. New anti-trust legislation may even be submitted to Congress next January. The Democratic party feels this campaign will portray it as the friend of labor and small business.

The Republican party, of course, realizes what is taking place, and, as expected, is launching steps to demonstrate sympathy for the "little fellow" also. The Republican method necessarily must be through the GOP-controlled Congress, hence a series of congressional investigations of business conditions are likely.

Recent trends indicated that both parties are aware that present conditions in which the oil industry finds itself makes it an ideal target. Last month the administration, through its Department of Justice, launched a grand jury study of price fixing and marketing conditions in Washington, D. C., and on the West Coast. It is hoped, of course, that evidence can be obtained on which trust suits may be based.

Meanwhile, the Senate Small Business Committee, headed by Republican Wherry, commenced its counter-offensive with a probe of complaints that small oil marketers cannot get enough supplies and hence are being squeezed out of business by major oil companies.

Most of the complaints against the industry at both the grand jury probes and the Senate committee hearings came from jobbers who in the past have purchased supplies on the spot market. Since many major companies are limiting their distributors to 1946 quantities and are declining to take on new distributors, the spot petroleum market has largely disappeared and jobbers who in the past did not buy from one source aren't able to find oil for sale.

Government Lacks Authority To Lease Tidelands

Although the U. S. government won proprietorship to California's offshore lands in a June 23 court decision, the matter is far from settled.

That the Department of Justice acknowledges that the issue is not settled was shown by the filing on September 15 of a proposed decree for enforcement. A memorandum accompanying the proposed decree draft stated further court action undoubtedly would be required. It is said the proposed decree would make no substantial change in the situation as it now stands, but was aimed at confirming and carrying out the court decision.

Meanwhile, another question was posed when it developed that the federal government did not have any authority to lease such lands. Attorney General Tom Clark advised the Department of Interior that submerged lands were not subject to the Mineral Leasing Act, which governs the leasing of public lands. On the basis of Clark's opinion, the Interior Department rejected 665 applications for tidelands oil leases. Most of the applications had been filed following the Supreme Court's California decision. Peculiarly, about 465 of the rejected requests involved coastal Louisiana lands, while only 194 sought leases along the shores of California.

Only Congress can provide the federal government with leasing authority. Hence, further lease applications will have to await enactment of special legislation by Congress.

It will be interesting to see what Congress does about the matter. Two years ago, Congress enacted a measure which granted tidelands ownership to the states, only to have President Truman veto it. Congress almost assuredly will be asked to pass similar legislation again, and at the same time will be asked by the Department of Interior to provide it with leasing authority. Thus, the whole question will be thrown into the lap of Congress despite the court decision.

Undoubtedly the tidelands question will develop into quite a "pressure" battle in Congress. The administration certainly will exert all its power. Meanwhile, led by Texas' Governor Jester, who is at every gathering attended by state officials, a strong array of opposing political power seems to be forming. This group is rallying around the fear that the decision is of serious concern to every state in the union, because it goes far beyond the ownership of offshore oil properties and establishes a new legal theory completely contradictory to previously established property rights. This contention is based on the court's ruling that the federal government's national defense responsibilities "transcended those of a mere property owner."

Meanwhile, a direct challenge of the federal government came when Texas announced it would proceed to offer about 2 million acres of tidelands for bids. The sale, set for November 4, will be watched with interest for two reasons: (1) To see if the attitude of oil men toward state ownership has been

cooled by the California decision; and (2) to ascertain if the federal government will remain indifferent to Texas' action. Texas' position may be different from that of other states, in that it specifically reserved all public lands upon joining the Union. However, the federal government at some future time probably will assert a nationwide claim of jurisdiction as a matter of national defense.

Standard's Hold-the-Line Price Policy Gains Backing

The "hold-the-line" price policy advocated publicly by Standard Oil Company (N. J.) has gained considerable strength, and prices of petroleum refined products may have reached their peak—at least temporarily.

This was indicated in early September, when The Texas Company and Shell Oil Company announced price reductions for gasoline, kerosine, and distillate in most of the Eastern states. Later, The Atlantic Refining Company and Gulf Oil Corporation also reduced their prices. In effect, the reduction marked a return to prices of a month previous, and reestablished these companies' prices on the same level with Standard's.

Most of the big marketers in the eastern district, including Shell, Atlantic and Texas, had followed the lead of Gulf and advanced their prices in early August. However, Standard held firm to its publicly-announced program of trying to hold prices.

The reductions were dictated by competitive conditions at the jobber level, with Standard jobbers taking gallonage and accounts from competitors although Standard had cautioned its jobbers against accepting new business because of the acute supply situation.

Saudi Arabia to Get Pipe Despite Strong Opposition

Over considerable opposition, the U. S. government in late September approved the exportation of pipe for building of a pipe line in Saudi Arabia. Approval of the export license means 300,000 barrels of Saudi Arabian oil will be on the international market by the end of 1949, when Trans-Arabian Pipe line Company expects to have the line completed.

The company desired to ship 40,000 tons of pipe in the fourth quarter of this year, and the same amount in five succeeding quarterly periods. The license granted covered only the fourth quarter of this year, but licenses for the other undoubtedly will be approved.

The question of whether the U. S. government should permit the exportation of materials for the construction of a 1000-mile pipe line from Saudi Arabia to the Mediterranean at a time when domestic operators cannot obtain enough steel for their own needs, had developed into a political controversy of considerable magnitude as well as a subject for heated debate in oil circles.

The issue was brought into the open when the Independent Petroleum Association of America fired a vigorous protest against issuance of export license, citing shortages of steel for domestic industry and demanding recognition of the influence of such action on American petroleum supplies. Russell B. Brown, association chief counsel, sent identical letters to Secretary of State Marshall, Secretary of Commerce Harriman, Secretary of Interior Krug, Army-Navy Petroleum Board Chairman Hoover, and the chairmen of nine Congressional committees concerned with oil and steel.

Senator Wherry, chairman of the Small Business Committee now investigating the oil supply situation, also protested the issuance of the license. Terming the question of "grave national and international significance," Wherry asked Secretary Harriman how the shipment of such a quantity "can be justified in light of present shortages of steel," and stated it was his opinion exports had played havoc with steel supplies over the past 1½ years.

Exports of Tubular Goods Soar in First Six Months

The question of exporting pipe for the Saudi Arabian line arose almost simultaneously with the release of data showing exports of oil field casing and line pipe had risen sharply during the first half of 1947.

According to Department of Commerce figures, exports of oil field casing and line pipe totaled 166,293 tons during the first half of the year, only 13,488 tons short of the exports of those commodities for all of 1946.

Unions Tolerating Communists May Lose Bargaining Rights

The refusal of labor unions to file anti-Communist affidavits as required by the new Taft-Hartley labor law raised the threat of a loss of bargaining rights and perhaps even the right to take cases to the National Labor Relations Board.

This development sprang from a ruling handed down in a Federal District Court in Fort Worth, which upheld the non-Communist portions of the law and also ruled the Oil Workers International Union ineligible for certification as a bargaining agent.

The issue was raised when the union asked for a court order requiring NLRB to count ballots cast in a bargaining election by employes of Deep Oil Development Company, Wichita Falls, Texas. Federal Judge Davidson said the anti-Communist portions of the Taft-Hartley law were legal, consistent and proper, and declared the OWIU was not eligible for certification as a bargaining unit because of the failure of it and its parent organization (CIO) to comply with this part of the law.

"The constitution guarantees a representative form of government," the judge declared, "and it is consistent and proper to throw restraint around any organization by denying privileges to those who would destroy this form of government." He then added that "Communism is recognized as not being a representative form of government. Communism is more the dictatorial type."

The OWIU had contended that its constitution bars Communists from membership and officers' positions, but Judge Davidson held that the union was an affiliate of the CIO which has not complied with the law and which has policy influence over its constituents.

The decision was seen as establishing a precedent for requiring unions to file such affidavits before they can take cases to the NLRB, since the board's general counsel, Robert N. Denham, has been holding up cases involving unions which have not filed affidavits.

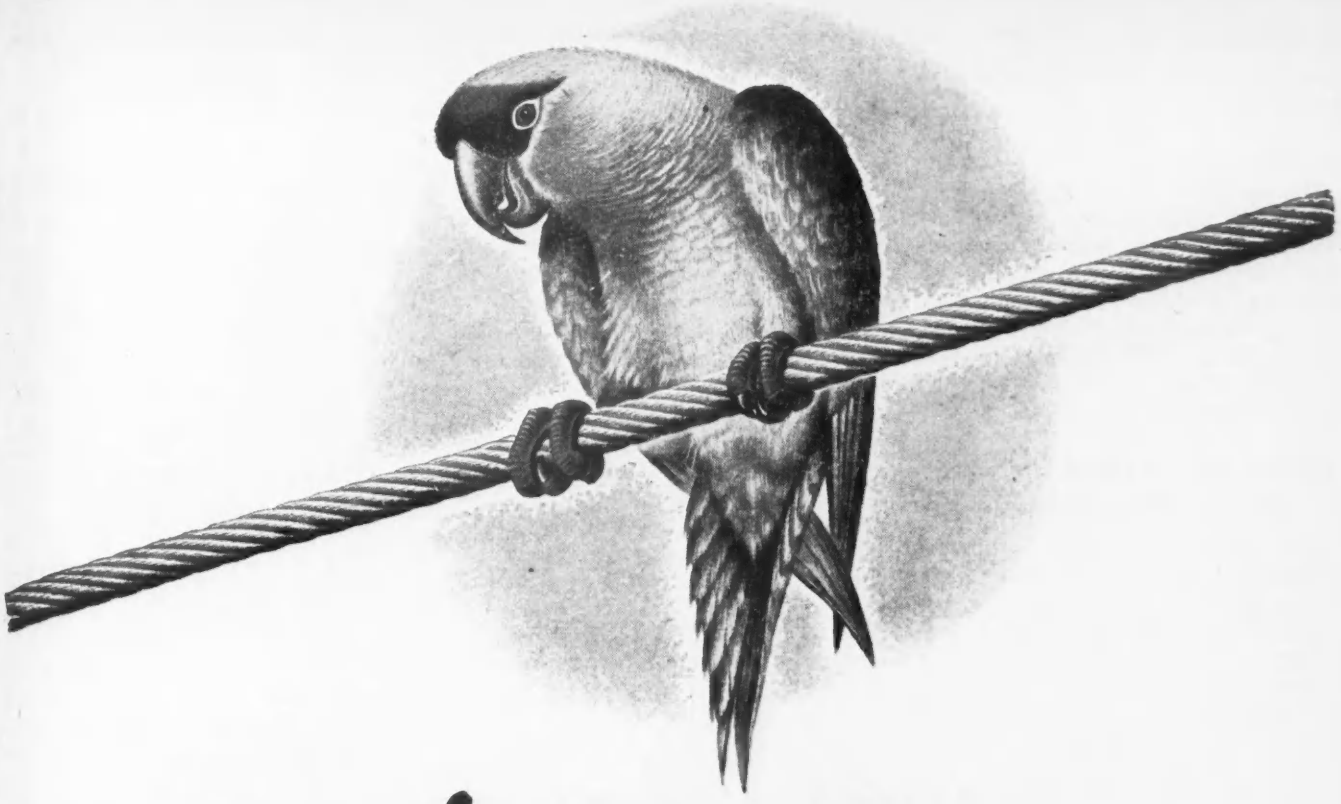
Officials of neither CIO nor AFL, the two national union organizations, have filed the affidavits, although a number of independent unions have done so. Should the district court's decision be upheld, all affiliates of the CIO and AFL unions may become ineligible for certification as bargaining units if their officials continue to persist in not filing non-Communist affidavits.

Union organization in non-organized plants, it is thought, may be impossible, unless the mandate of the law is carried out.

Texas Abandons Shutdown Days After Eight Years

Further evidence of how near present producing rates are to maximum efficient levels came when the Texas Railroad Commission issued its proration order for October. For the first time in eight years all fields in the state, with the single exception of the East Texas field, were exempt from shutdown days.

Commission Chairman Thompson ex-



Can't We Sing Any Other Tune?

Not long ago somebody said to a Bethlehem man, "You folks are always harping on the 'right' wire rope. Why do you make such a point of this?"

Because it's a fundamental that no purchaser should ever overlook. The *right* wire rope for any given job means longer rope life . . . better service . . . more for your money.

Wide differences exist in wire ropes. There are many constructions, many sizes, different lays and cores. Several grades of steel are used in their making. The rope that's perfect for one kind of work may not do at all for another kind.

It's just plain throwing money away to figure that "any old rope will do"!

We'll be glad to look over your equipment and help you check your wire-rope needs. Ask a Bethlehem engineer to stop in. He's a specialist who knows the *right* wire rope for every type of machine.

When you think WIRE ROPE . . . think BETHLEHEM

plained that this was the "first time demand has been large enough to allow the field to produce every day."

The net daily allowable of the state was set at 2,555,224 barrels, or 9477 barrels below the allowable as of September 13. Under this plan, the removal of shutdown days was expected to result in an average actual production of approximately 2,376,000 barrels per day, or 40,000 more than the average daily output in recent weeks.

Quota Plan Adopted for Government Requirements

In an effort to procure enough oil to fulfill military-government requirements, the Oil and Gas Division of the Department of Interior last month launched a refinery government quota plan. This unusual action was taken because of the difficulty the government has experienced in getting a sufficient quantity of oil to meet its needs.

In letters bearing the signature of Department Secretary Krug, 52 companies with refineries exceeding 10,000 barrels per day capacity were asked to set aside definite amounts for government use. Warning that an emergency would develop unless essential government requirements were met, refineries were asked to make the "fullest possible tender to the government" regardless of capacity or location of refining plants. Letters to the different companies were identical, except as to quotas given the individual firms.

In a press statement, Krug said the government would need an average of 287,500 barrels per day during the last six months of 1947 and almost 300,000 barrels daily during the first six months of 1948.

Geophysical Work in Gulf Protested by Fishermen

Complaints of Texas fishermen that large quantities of fish are being killed by increasing geophysical shooting in the waters of the Gulf of Mexico were to result in rules regulating methods used in searching for oil in tidelands.

The argument, which has been developing for several months, reached a high pitch late in September at public hearings before the Texas School Board. The purpose of the hearings was to determine how much damage was occurring and what regulations might be adopted to reduce dangers to fish life. A 17-man committee was named to draw up a control plan for consideration.

From testimony presented at the hearing it appeared probable that the program would include the following points: (1) suspension of explosive charges above the ocean floor; (2) limitation of the explosive charges; (3) prohibitions against leaving obstructions or lighted buoys; and (4) prohibitions against shooting within a specified distance of a fishing boat already in the area.

Whether the committee could satisfy the oil interests was problematical; its very existence had already aroused a new outcry from a segment of the opposition. Sherwood Brown, acting county attorney of Galveston County, questioned the authority of such a committee, said geophysical shooting in the Gulf is against the law, and threw out the committee's findings in advance with the announcement that "The county attorney's office cannot and will not recognize any agreement between individuals . . . to violate criminal laws of the state."

Confusion Lingers on Control Of Gas Production, Gathering

Confusion as to whether actions of the Federal Power Commission will result in regulation or control of production and gathering of natural gas continued as the month closed, although a new FPC order issued during September finally acknowledged industry claims that its authority did not extend this far.

Continuation of the confusion and need for clarifying the Natural Gas Act springs from the failure of the commission's order to specify where production and gathering operations end and interstate transmission begins. In the opinion of oil and gas producers this is the crux of the entire issue, and consequently they did not agree that the existing uncertainties as to the commission's position had been clarified by the order.

The order declared it was the opinion of the FPC that Congress intended "the control of production or gathering of natural gas should remain a function of the states and that the Natural Gas Act should not provide for regulation of these subjects." The order added that in administering the act, FPC will construe the section exempting production or gathering as "including arm's-length sales of natural gas by independent producers and gatherers, made during the course or upon completion of production and gathering," and promised that the commission "will not assert jurisdiction over such producers and gatherers who might be subject to jurisdiction solely because of such sales."

In the absence of any definite definition, however, industry men asserted no one could be certain whether his particular sales would be considered subject to FPC jurisdiction, and that, therefore, it would be necessary to get an opinion from the FPC in all instances.

The latter view was held to be particularly true in view of the recent decision in the Interstate Natural Gas Company case, in which the U. S. Supreme Court held that anyone selling gas which eventually crosses a state line is a natural gas company subject to FPC jurisdiction under the Natural Gas Act.

As a result, most oil and gas producers still were of the opinion that the matter could be resolved to the satisfaction of those affected only by amending the Natural Gas Act so it would contain the necessary definitions needed to clarify the situation. At its last session, the House passed the Rizley-Moore bill which specifically defines where production and gathering operations end and where interstate transmission commences, but the Senate failed to take any action on the measure before it adjourned.

Larger Immediate Gas Market in Prospect

Whether producers in Texas and Louisiana are to have a larger natural gas market and consumers in the eastern district of the U. S. are to have bigger quantities available for consumption within six months is due to be determined shortly.

After eight weeks of hearings, the Federal Power Commission on September 22 heard oral arguments on the application of Texas Eastern Transmission Corporation to acquire and operate the two government-built Big Inch war emergency pipe line systems. An early favorable decision is expected in view of the need for gas in the Eastern area.

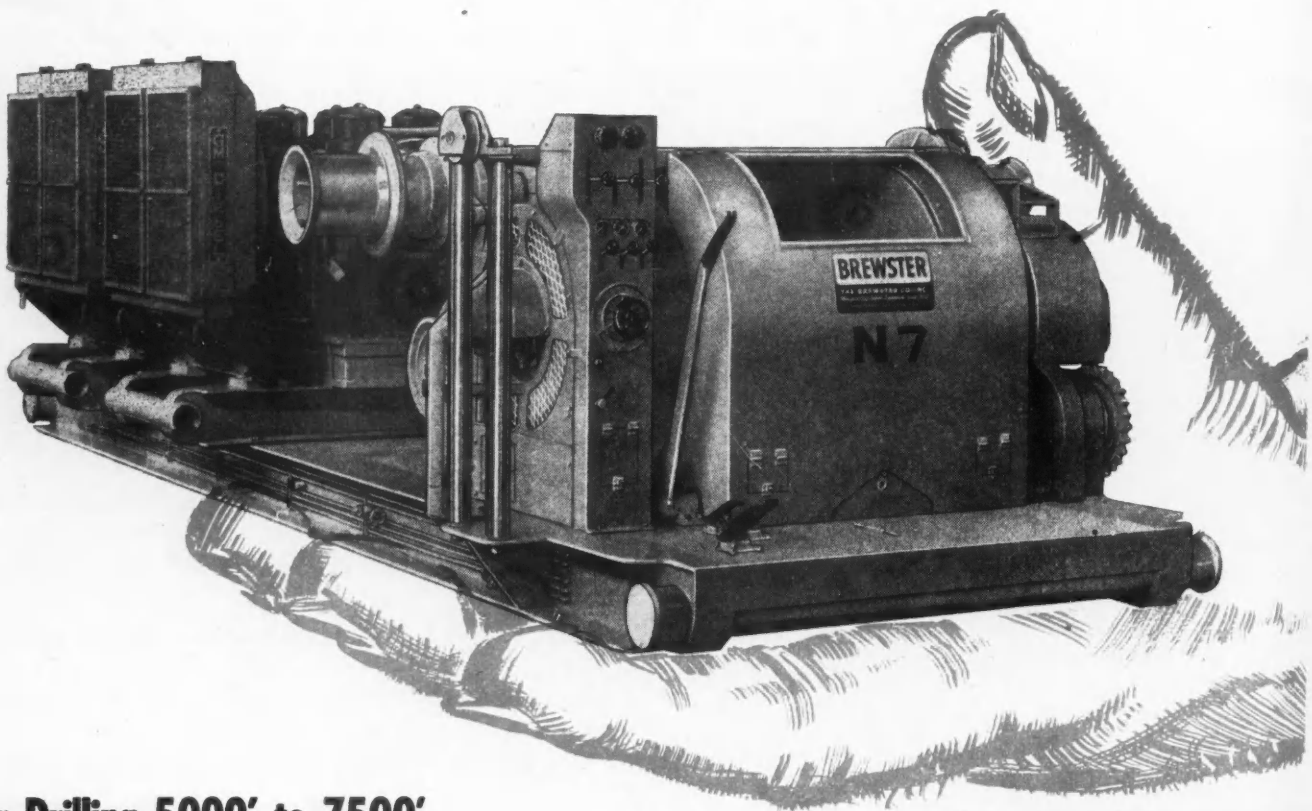
Under a temporary lease and operating certificate granted last spring, Texas Eastern has been moving about 140 million cubic feet of gas daily into the Appalachian area. Four additional compressor stations to boost this rate to 265 million cubic feet are to go into operation by November 1. It is planned to have six more compressors in operation by February, 1948, to boost capacity of the two lines to 340 million cubic feet daily.

If FPC issues a permanent certificate promptly, the company expects to have 11 additional compressors in operation by August, 1948, which will bring the capacity of the systems to 433 million cubic feet per day.

Something to tie to
WHEN you tie to anything, you want to be sure *that* tie will hold.
When you cement pipe in an oil well, you tie the casing to the formations and you want to be *certain* it will hold—hold all fluids in proper place—hold for the life of the well.
Select a LONE STAR Cement—field performance proves that these Cements are "something to tie to." Select the Cement that fits your job.
LONE STAR CEMENT CORPORATION
Offices: DALLAS • HOUSTON • NEW ORLEANS • KANSAS CITY, MO.
BIRMINGHAM • JACKSON, MISS. • INDIANAPOLIS • ALBANY, N.Y.
BETHLEHEM, PA. • BOSTON • CHICAGO • NORFOLK
PHILADELPHIA • ST. LOUIS • WASHINGTON, D. C. • NEW YORK
SELECT CEMENT TO FIT THE JOB
LONE STAR CEMENT CORPORATION
84 LBS. NET
LONE STAR PORTLAND CEMENT
INCOR
HIGH EARLY STRENGTH
PORTLAND CEMENT
OIL WELL CEMENT

COMPLETE CONTROL

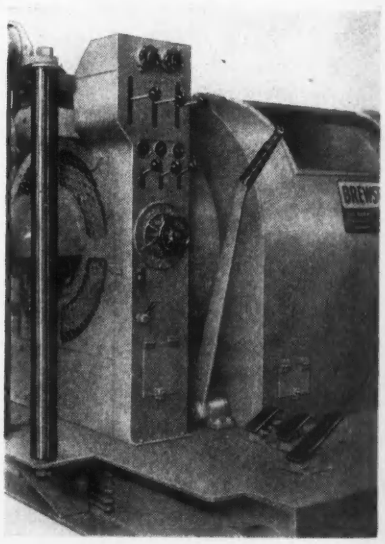
in the palm of your hand . . .



For Drilling 5000' to 7500'

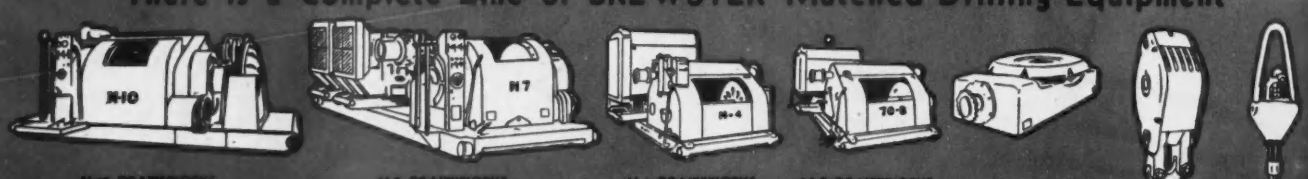
The BREWSTER N-7

Effortless operation, quick control, and reserve power are the features that have made the Brewster N-7 Drawworks popular with drillers everywhere. A control panel at the drillers position is the nerve center of the entire rig. Power is controlled thru an oil bath compound and 4-speed 500 H.P. transmission giving 8 line speeds. Low drum turret allows unobstructed visibility. Every detail reflects Brewster's 37 years experience in building fine drilling equipment.

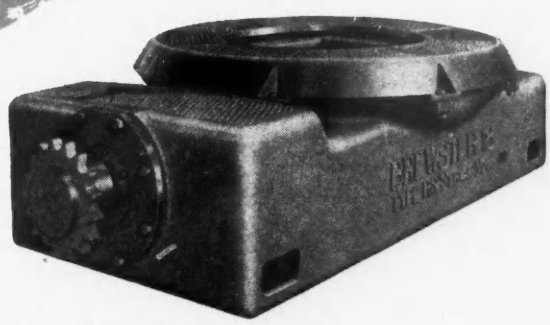


Right: From this panel at driller's position you have quick and complete control of the entire rig at all times. Air operated fingertip control of all friction clutches, catheads, and transmission. Note pressure gauges at eye level. Foot and hand throttles. It operates as easily as a modern automobile.

There is a Complete Line of BREWSTER Matched Drilling Equipment



. . . . with the added advantage of Brewster *MATCHED* Equipment



RS-18 Oilbath Rotary

This is the favorite high speed rotary of deep well drillers. Box-type one-piece steel base and skid designed to take the heaviest shock load. Precision ground ring and pinion gears, and main table bearing are oilbath lubricated. Slushproof table with full 18" opening. Positive table lock, conveniently located. Compact and easy to move.

SOLD BY THESE SUPPLY STORES
in the Mid-Continent Area:

BOVAIRD SUPPLY CO.
INDUSTRIAL SUPPLY CO. • REAMS SUPPLY CO.

Export Sales:
BAIRD SUPPLY CO., INC.
420 Lexington Avenue
New York 17, New York, U. S. A.

200 Ton Traveling Block

Perfectly balanced with low center of gravity for straight line travel. Each of 5 sheaves mounted on double-row tapered roller bearings, individually lubricated. One-piece streamlined side plates—no protruding parts, all bolts recessed for safety. Bail serves as footing allowing block to remain in upright position when resting on derrick floor. Companion Crown Blocks available.

6-S Oilbath Swivel

This heavy duty model has a capacity of 220 tons. Anti-friction bearings with ample overload capacity run submerged in oil. Large streamlined body provides big oil reservoir for positive, continuous lubrication and cooling. Heat treated stem and bail. Full opening stem and gooseneck. Widely spaced stabilizer bearings assure perfect alignment. Other models available from 50 to 300 tons capacity.

Write for our catalog showing the complete line of Brewster Drilling Equipment.

The BREWSTER CO. Inc.

Manufacturers of Drilling Equipment Since 1910

SHREVEPORT, LOUISIANA, U.S.A.

BREWSTER
Drilling Equipment

Looking Ahead

ANOTHER CRUDE price advance is likely before the end of the year, despite attempts to hold prices. If not advanced in the next few months, an increase is almost certain during the early part of 1948. Supply will be tighter then, demand being due to rise substantially above present peak levels.

PROSPECTS are that high crude prices will exist during the next five years. Outlook for continued sharp growth in consumption is so very favorable, there appears little likelihood that excessive producing capacity can be developed until after that time. Chances are that the world will consume all the petroleum that can be made available between now and 1952.

CONGRESSIONAL approval of a broad European aid program would have pronounced upward effect on demand for steel. This would make U. S. present shortage more acute, and also would lengthen the U. S. shortage period.

BURDEN of forestalling a deficit in the U. S. petroleum supply falls largely upon the Permian Basin area of West Texas-New Mexico. With hundreds of proved undrilled locations, an unusually high discovery rate, and already one-fifth of the nation's crude reserves, this area is to experience great expansion. Production of the region will reach 800,000 barrels daily by end of this year, about 2½ times its prewar rate, and will increase to 1 million barrels daily as soon as additional pipe line can be constructed. More about this on page 53.

DUE TO continuing shortages of pipe, compressors, and other equipment needed to expand facilities for bringing in the gas from the Southwest, no material improvement is expected in supplies of natural gas available for the Appalachian region this coming winter. Consequently, gas companies are obliged to try to avoid taking on new customers, pending expansion.

ULTRA HIGH-SPEED photography using stroboscopic light makes possible study of hitherto unknown fuel spray patterns from injection nozzles in internal combustion engines. By revealing fuel spray characteristics more efficient combustion should be attained, still further extending the field of usefulness of the diesel-type engine.

A TAX reduction bill likely will be high on the list of "must" legislation when Congress next convenes. Lower tax rates are considered imperative as an incentive for work and expansion of production.

INDEPENDENT oil jobbers are courting the danger of renewing efforts to place the petroleum industry under federal control in their complaints about a squeeze play in the current tight supply situation.

TO PROVIDE adequate supply for soaring consumption, the U. S. petroleum industry needs to expand its drilling rate in proportion to the increase in demand. This would mean the completion of 40,000 wells this year instead of the 35,000 expected. This fact, coupled with enlarged drilling operations abroad, indicates requirements for oil country tubular goods have increased to somewhere close to twice the prewar annual average of 1 million tons. See story page 60.

VIBROFLOTATION, a method for compacting sandy soil to increase its load-bearing capacity, is expected to simplify foundation problems in shoreside installations, and thus to permit more efficient use of such space for loading facilities.

Bright Spot In U. S. Oil Picture

By H. H. KING
Staff Writer

THE GREATEST production gain of any oil-yielding area in the U. S. is in prospect for the sprawling Permian Basin. This bi-state district has the developed and proved undrilled reserves to push its output of crude and natural gasoline products above the million-barrel-a-day mark, contingent upon (1) additional transportation and (2) the long-range development plans of the score of companies who own the area in large part. The accompanying article is a thoroughgoing review and prospectus of development in the great Basin, written by a WORLD OIL staff writer who has maintained a day-to-day check on the area for more than 25 years.

THE burden of forestalling a deficit in the nation's petroleum supply falls upon the Permian Basin. This bi-state district, centering upon West Texas and southeastern New Mexico, has the developed and proved undrilled reserves to make the largest regional production gains. Its production of crude and natural gasoline products will progressively advance above the million-barrel daily mark.

Such a goal will not be attained for for several years due to the postwar scarcity of tubular goods for the required additional wells and transmission lines. Further delay may arise through the fact that the proved undrilled reserves and most promising untested prospects are largely owned by a score of companies that abide by a long-range development program in given areas to protect their respective refinery and market requirements.

Production in the Permian Basin is advancing steadily to higher levels as additional pipe line facilities and tank cars become available. During June the district averaged 703,000 barrels daily, exclusive of natural gasoline production. Crude output is currently averaging 785,000 barrels daily, with prospects of reaching the 800,000-barrel daily level before the end of the year through the completion of scheduled trunk line loops and the utilization of more tank cars.

Transportation will govern production gains for another year. Trunk lines serving the district averaged 621,500 barrels daily during the first week in June. Additional loops and booster station units enabled these same carriers to maintain a daily average movement of 682,850 barrels during the first week in September. Tank car shipments of crude to points in Canada, Michigan, Indiana, Illinois, Kansas and Texas averaged 91,500 barrels daily during the first week in September, representing a 28,000-barrel increase over the first week in June average.

Movement of crude by tank cars will exceed 100,000 barrels daily before the end of the present year. Trunk line outlets will be boosted another 250,000 barrels in daily shipments late in 1948, eliminating the necessity of supplemental movement by tank cars for all pipe line companies.

Local refineries are absorbing from 40,000 to 45,000 barrels daily of the Permian Basin's production.

The allocation of another 250,000 barrels to the daily pipe line capacity available to the Permian Basin requires an expenditure of more than $30 million. Participating companies made thorough appraisals of the known and potential reserves prior to authorizing the projects, which have not been equalled in proportions since the advent of the East Texas field.

Cumulative production in the Permian Basin passed the 2 billion-barrel mark early in July of this year. Total for the district as of June 30 amounted to 1,999,065,000 barrels, with the West Texas sector accounting for 1,998,562,000 barrels. Lea County, New Mexico, recorded a total of 453,224,169 barrels as of this date, while the remainder is distributed among numerous small fields in Eddy County.

The ability of the Permian Basin to boost its crude reserves to higher levels when given an incentive market has been demonstrated for a score of years. The district contains so much virgin territory that geological and geophysical staffs have succeeded in locating promising structures in greater numbers than those explored. There has been a tendency to defer drilling of good prospects when lease terms permitted the delay in view of the market restrictions imposed upon the developed fields.

Crude reserves available in the Permian Basin reached an all-time high of 4,315,000,000 barrels at the close of June, 1947. This represents about one-fifth of the nation's total. West Texas is credited with 3,514,752,000 barrels, while Southeastern New Mexico has 800 million barrels of recoverable oil.

Likely Trends

While the Permian Basin has contributed exceptionally large fields such as Slaughter, Wasson, Eunice-Monument, with numerous areas falling within the 15,000 to 20,000-acre listing, the reserves of the future will be found in the deeper Permian and pre-Permian

beds. An analysis of the important discoveries within the past three years emphasizes this trend of developments.

New Mexico's crude reserves have resumed a trend within the past year as a direct consequence of the successful development of deeper Permian and lower pays in Lea County. Further gains are assured since the county's most promising deep-pay prospects have not been explored.

Deep discoveries and lower pays in established fields are becoming larger contributors each year to the reserves of West Texas. The regular Permian zones, such as the Yates, Grayburg and San Andres, register the most discoveries due to a high percentage of the wildcats having these zones as their objectives. However, these have been noticeably smaller in productive area within the past several years. Few sections of the district have areas of such proportions as the Yates or Slaughter fields that have not been explored to the San Andres, so the big fields in the future must fall within the deep-pay category.

The qualification of a "deep-pay" in West Texas is elastic. The Permian produces at intervals from the grass roots to a maximum of 10,853 feet in Reeves County, which has a small flowing well from the Wolfcamp. Ellenburger, the oldest in geological age, produces at a minimum of 4307 feet in Pecos County, and Andrews County has the deepest with a well bottomed at 11,955 feet.

Ellenburger production is the prime objective of all deep tests. The oil is generally of premium quality and low in sulfur content. Crude in some Ellenburger areas, particularly Big Lake, Keystone, Kermit, and the Block 31 field, yields lube stock material comparable to the Pennsylvanian grade. The district's Ellenburger fields will record a higher average crude yield per acre than any of the other known pays. Big Lake field, the original deep area, has averaged about 25,000 barrels per acre from this zone. The thick section of Ellenburger pay encountered in the Keystone, TXL, Todd and University-Waddell fields assures an ultimate recovery of 25,000 to 30,000-barrel average per acre.

The percentage of successful deep-pay completions by wildcat has been adequate to warrant the drilling of an Ellenburger test as the initial exploration on any structure of merit. Such tests costs from $50,000 to $450,000, depending upon the depth and thickness of the chert beds, if any are encountered. A thorough test to the Ellenburger watertable takes in the established oil zones, thereby confirming or condemning a given area with a single test. Failure to make a decisive test has resulted in the redrilling of numerous prospects in recent years.

Statistics reveal that most Permian Basin structures that produce from the Ellenburger also have upper pays. Deep-seated structures have the highest performance record for multiple pays, which generally include the Devonian. The initial deep test for the Keystone structure encountered six prospective oil zones below the San Andres. Four of these are now important sources of production, while the Clear Fork and Simpson will be tapped later this year.

Ellenburger prospecting has uncovered commercial oil production from two new horizons within the past three years. The Devonian cherty-lime beds, previously passed up as supposedly barren, is now an important source of sweet and semi-sweet crude. The Wolfcamp, Basal Permian limestone, is productive in five counties, but is erratic in performance and subnormal in crude yield per ace.

Proved Undrilled Locations

Numerous West Texas fields have a backlog of more than 100 proved undrilled locations. Possibly more than 200 additional wells will be drilled in the Levelland field, which is progressively advancing westward to link with the Whiteface sector of the Slaughter field. The multiple-pay Keystone structure will add more than 200 wells before development is concluded. The TXL field is assured of more than 100 new wells in view of the fact that the Ellenburger and Devonian, principal oil horizons, are subject to extensions northwest and southeast, while the Clear Fork is productive over a large portion of the structure. Sectors of the field that have indicated flush production from the Silurian and Simpson will be developed. A minimum of 100 additional wells are in store for the Fullerton, North Ward-Estes, McElroy and Goldsmith fields. The latter structure has local highs below the San Andres beds that will account for a series of deep-pay areas which will attain importance. An unpredictable volume of drilling is in store for recent discoveries that have not been developed sufficiently to forecast their productive limits.

Prior to deep-pay explorations, the Permian Basin was predominantly a sour crude producer. West Texas is currently producing more than 150,000 barrels daily of sweet and semi-sweet crude. The latter is near the border line on sulfur content that establishes the grades for price postings, and receives an intermediate price. The Fullerton area, and most Devonian fields fall within this classification. Lea County's Brunson-Ellenburger field commands the top Mid-Continent price postings in recognition of the quality of the oil, while the expansive Drinkard field has been assigned the intermediate price schedule.

Permian Basin

The tendency of Permian Basin oil fields to prevail in definite trends became apparent after the opening of the McCamey field in 1925. Geology, geophysics and other present-day methods of outlining prospects were somewhat haphazard during the pioneer days of exploring the basin. The production trend theory netted quick results when wildcatters followed a northwesterly course from the McCamey field. Nearby Crane-Cowden, McElroy, Church and Fields, Waddell and Penwell fields were uncovered within the next two years. Additional strikes along this trend lagged for a few years, then was pushed beyond Penwell across Ector and Andrews counties, which later were found to offer a multiple trend of fields that prevail at intervals to the north end of the basin. The Yates field became the only major strike in a general southeast trend from the McCamey area, although small intermediate pools and some farther southeast have since been uncovered.

The trend theory of production proved to be more pronounced to the west and near the junction of the Permian and Delaware basins. Random drilling in Winkler County resulted in the discovery of the Hendrick field in 1926 from porous lime, with an exceptionally effective water drive. The northwest-southeast trend prevailed again. Comparatively small lime fields made their appearance to the southeast across Ward County and into Pecos County, while the New Mexico prospectors scored at Jal, Eunice and Eaves during 1929 in the order named.

Presence of a sandy-lime producing trend of greater average width to the east of the trend established by the Hendrick field became known in October, 1927, through the discovery of the Scarborough field, Winkler County. This strike was followed within a few months by the discovery of the Rhodes field, New Mexico, with production later advancing by stages about 20 miles north by west across what is now designated as the Langlie-Mattix field.

Another 20 miles of continuous oil production prevails north from the Langlie-Mattix field, and across the Penrose-Skelly, Hardy and Skaggs fields, but the oil occurs in the underlying Grayburg lime, or basal Whitehorse.

The southeast trend from the Scarborough field also progressed rapidly across Winkler and Ward counties and deep into Pecos County. This string of fields includes Keystone-Colby, with Kermit opposite to the west, Emperor Deep, with Weiner opposite to the east, Emperor, Halley, North Ward-Estes,

Steam . . . water . . . oil . . . or gas
CRANE Supplies all Piping equipment

. . . A good thing to remember for a simplified piping job every time . . . on new or replacement installations. No matter what the fluid or working conditions, see the Crane line first for *all* piping equipment . . . and for dependable quality in every item.

For this water supply system, for example, the Crane Catalog puts everything at your finger tips . . . valves, fittings, pipe, and pipe line accessories. One order to your Crane Branch or Wholesaler covers all your needs. From design to erection to maintenance, your piping job moves fast and smooth . . . with good performance assured . . . because you get this 3-way advantage:

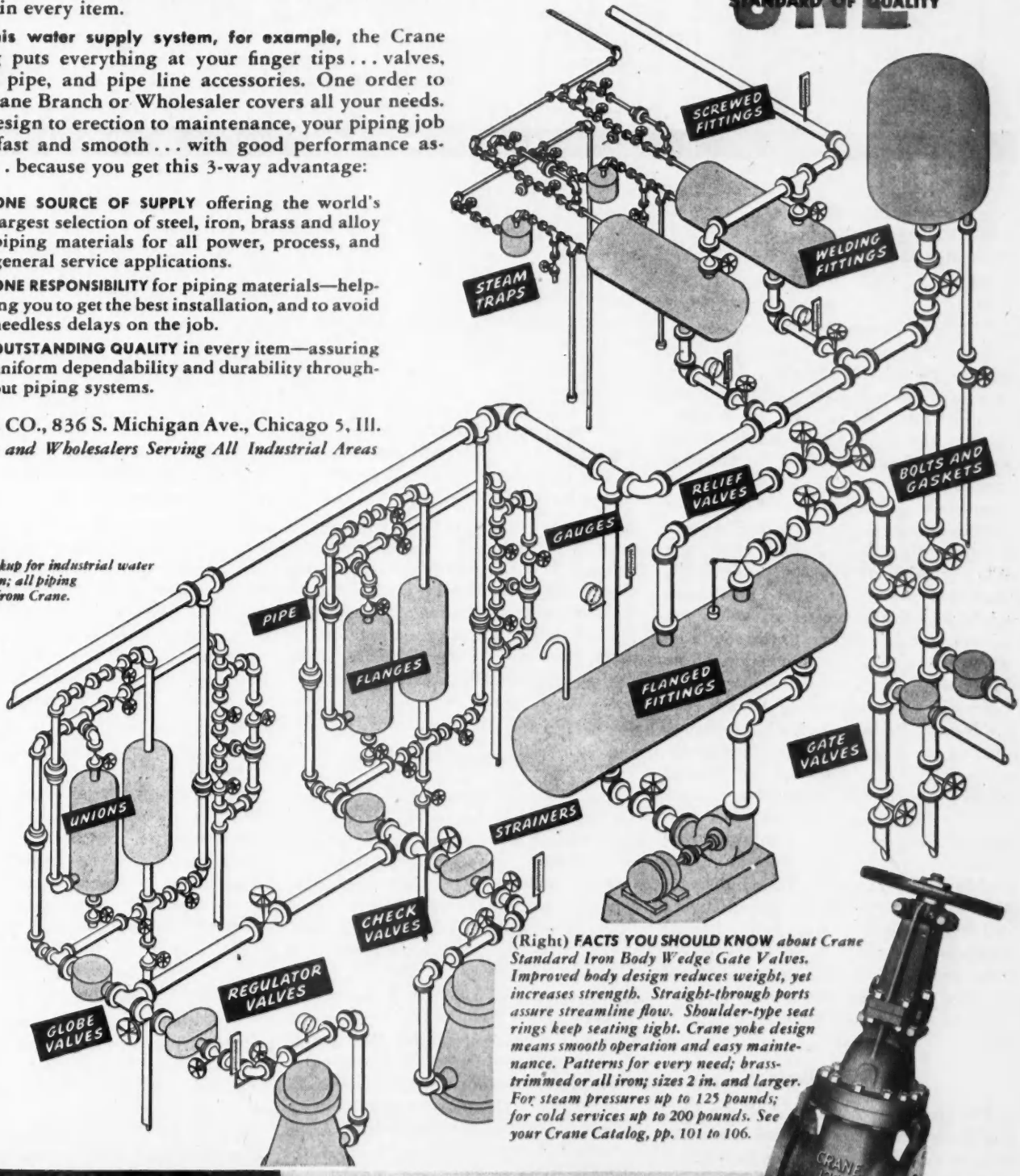
ONE SOURCE OF SUPPLY offering the world's largest selection of steel, iron, brass and alloy piping materials for all power, process, and general service applications.

ONE RESPONSIBILITY for piping materials—helping you to get the best installation, and to avoid needless delays on the job.

OUTSTANDING QUALITY in every item—assuring uniform dependability and durability throughout piping systems.

CRANE CO., 836 S. Michigan Ave., Chicago 5, Ill.
Branches and Wholesalers Serving All Industrial Areas

ONE
SOURCE OF SUPPLY
RESPONSIBILITY
STANDARD OF QUALITY



Typical hookup for industrial water supply system; all piping equipment from Crane.

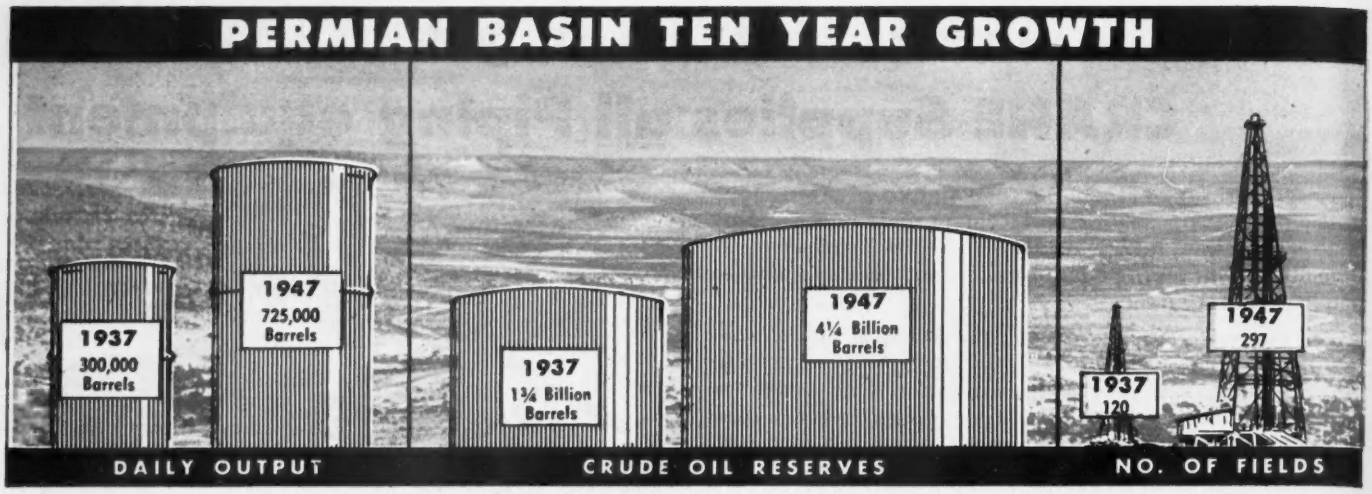
(Right) **FACTS YOU SHOULD KNOW** *about Crane Standard Iron Body Wedge Gate Valves. Improved body design reduces weight, yet increases strength. Straight-through ports assure streamline flow. Shoulder-type seat rings keep seating tight. Crane yoke design means smooth operation and easy maintenance. Patterns for every need; brass-trimmed or all iron; sizes 2 in. and larger. For steam pressures up to 125 pounds; for cold services up to 200 pounds. See your Crane Catalog, pp. 101 to 106.*

EVERYTHING FROM . . .

VALVES • FITTINGS
PIPE • PLUMBING
AND HEATING

CRANE

FOR EVERY PIPING SYSTEM



with Shipley immediately east, Payton, Pecos Valley, then embracing a widely distributed group of small fields as far south as the Fort Stockton field, Pecos County.

Possibility of equally pronounced production trends occurring in pre-Permian fields, especially Ellenburger, have not been overlooked by the operators in acquiring protection acreage. In Winkler County, the southeast trend from the Keystone-Ellenburger field has been regarded most favorably by numerous companies, although two Ellenburger failures along the general strike were disappointing. The Dollar Hide and Wheeler fields are expected to mark the beginning of a parallel northwest-southeast Ellenburger trend, which was showing for an addition to the southeast through the pending completion of an Ellenburger discovery in southwestern Ector County. Progressing farther east, the Nelson, Bedford and TXL fields are situated on a general northwest-southeast trend. The Martin, Embar and Andector fields, all multiple-pay areas with the Ellenburger as the most productive zone, provide another trend that eventually will include a sector of the Goldsmith structure. The Fuhrman-Mascho pumping Ellenburger discovery and the Fullerton areas are situated northeast and north, respectively, of the latter group. Crockett County is destined to provide an Ellenburger production trend as new strikes make their appearance.

Delaware Basin

The Delaware Basin, west of the Central Basin Platform that has made the greatest contribution of fields to the Permian Basin region, is an important potential source of production. Companies with a long-range program are holding large blocks of leases as protection against a general revival of exploratory work in the region. Delaware production has made a creditable showing in the Wheat and Mason fields, largest strikes to date, and has a record for long flowing life. There are a few scattered pools in Reeves and western Ward and Pecos counties that serve as a reminder that this region is capable of producing sweet crude. The completion of a Wolfcamp flowing producer in Reeves County provides a new objective, although this Basal Permian zone is normally below par in crude yield per acre. This strike precipitated a major lease buying program that will result in the drilling of exploratory tests before leases on the large blocks expire.

Several attempts to explore the Delaware Basin proper for deep production revealed that the pre-Permian beds are abnormally deep. However, pre-Permian beds are fully developed at reasonably shallow depths on the west side of the basin, and exploratory tests are under way in Culberson and Hudspeth counties, Texas, and Otero County, New Mexico.

Yates Field

The prolific Yates field ranks among the greatest of the nation. It has recorded the largest gauged wells, ranging up to 204,682 barrels daily rate at 1070 feet. The outstanding wells have production allowables that surpass the potential rating of an average completion in other fields. The highest base allowable is 2189 barrels daily for a single well on a 100-acre unit. Thirteen proration units, bearing single wells, have produced in excess of 1 million barrels each, while 20 units with two to four wells each also have averaged more than 1 million barrels per well. The most productive well, situated near the northeast edge of the structure, has produced more than 10,800,000 barrels. The next largest has contributed 10,200,000 barrels.

The Yates field occupies second place among Texas fields for cumulative production and ultimate recovery from known producing horizons. The San Andres lime, or main pay, has produced 321,835,000 barrels, besides 3,652,691 barrels of seepage oil derived from pits during the early period that defective casing caused when porous beds near the surface to become charged with oil. Similar migratory oil that is produced through shallow pumping and flowing wells along the north and east edges of the structure is officially classed as Tobarg field production due to the similarity of producing depths. The Smith sand sector, which lies within the San Andres lime producing area, has accounted for 762,222 barrels from 19 pumpers in the Yates sandstone.

An average of 15,500 barrels per acre is credited to the 20,650 acres of San Andres lime area, which listed 578 active wells, including 513 flowing producers, at the close of June. Twelve additional oil completions have been plugged due to becoming junked, else making excessive water. The average recovery for all oil wells totals 545,483 barrels.

Remaining reserves in the Yates field's known oil horizons are conservatively calculated at 342,180,000 barrels, being greater than withdrawals to date. These reserves are most likely to be enlarged somewhat, as comparatively few lime wells have drilled the 225-foot maximum penetration. Upon the passing of the flush stage this pay penetration restriction will be cast aside so as to revive flow through deepening. Secondary recovery methods eventually will be applied, thereby adding to the reserves.

The Slaughter field, embracing 75,305 developed acres that extend into portions of Cochran, Hockley, Terry and Yoakum counties, is the largest in the Permian Basin. The productive acreage eventually will exceed 100,000 acres, as the Dean field on the west end will be merged through having been joined by production. The greatest addition will occur in the Whiteface, or northwest sector, centering upon the Cochran-Hockley County line. A substantial development program has been under way for months that has steadily expanded the productive limits to the north and east.

STAR PERFORMANCE IN THE PETROLEUM INDUSTRY

D-X holds a success record that has made petroleum marketing history. Quality is the basic factor in two great companion products. D-X *Lubricating* Motor Fuel is one gasoline that is *different.* At no extra cost, it provides lubrication to upper cylinder parts. D-X Motor Oil assures Top-Flite protection —it is a premium oil that "Cleans as It Lubricates." As further proof of quality, D-X Products are sold on a genuine Money-Back Guarantee. Distributors and Dealers are invited to investigate the profit possibilities of the D-X franchise.

MID-CONTINENT PETROLEUM CORPORATION

Waterloo, Iowa · Terre Haute, Ind. · TULSA, OKLA. · Chicago · Omaha

HUNDREDS OF GASOLINES BUT ONLY ONE D-X

SPECIAL PERMIAN BASIN FIELD DATA SECTION

A special section of this issue gives pertinent discovery, geological, development and production data on all fields in the Permian Basin area of West Texas-New Mexico. This section begins on page 271.

Also accompanying this issue is a folded insert, multi-colored field map of the region.

The latter trend is wide open for a hook-up with the Levelland field.

Slaughter field has been producing since October, 1936, and its 2109 flowing and pumping wells have accounted for 101,939,752 barrels. The remaining reserves, exclusive of prospective producing acreage, amount to 312,237,000 barrels, being the third largest in the Permian Basin.

Development of the Wasson field, centering upon the Yoakum-Gaines County line, is about concluded, except for the two Clear Fork zones. This field's 58,400 developed acres have produced 133,575,310 barrels from 1369 flowing and 192 pumping San Andres wells. Remaining reserves are calculated at 508,900,000 barrels for top rank among the Permian Basin fields. Two Clear Fork oil zones in the south portion of the field have produced 1,586,330 barrels from 31 flowing and pumping wells, with reserves calculated at 6,343,000 barrels. The latter are being developed on an 80-acre spacing pattern in view of the anticipated low crude recovery per acre. The single Ellenburger failure at 11,108 feet that proved the Clear Fork for production in plugging back is not considered a decisive test of pre-Permian production possibilities of such a large structure.

The backlog of reserves credited to the San Andres zone in the Wasson field is due to development occurring within the past eight years while the market outlet failed to expand proportionately. This area was discovered in 1936 as the forerunner of a series of strikes in the north portion of the Permian Basin. The isolated position of this strike is illustrated by the fact that it was then 28 miles from the nearest San Andres lime test. The nearest producing areas consisted of the Hobbs field, New Mexico, 33 miles southwest, and the Means field, 42 miles southeast. Production from the San Andres did not attain importance until 1940, when the yield amounted to 10,976,744 barrels. The annual output was allowed to reach an all-time peak of 23,725,909 barrels during 1944, and during successive years has averaged 21,000,000 barrels annually. The restricted output has prolonged the flowing life, as only about 12 percent of the wells are on artificial lift.

Seminole field made its appearance late in 1936. It is on a direct trend between the Means and Wasson fields. Pre-discovery geophysical surveys proved unusually accurate in outlining the productive area. Inadequate market outlet retarded development. The annual production rate did not pass the million-barrel mark until 1941. Production attained a peak flow of 8,777,396 barrels during 1944, then progressively cut back to its current annual rate of 6 million barrels. Cumulative production amounts to 35,858,223 barrels, while reserves are calculated at 162,142,000 barrels from 13,200 acres.

New Mexico

New Mexico's participation in the Permian Basin development is confined to Lea, Eddy and Chaves counties. This tri-county area has produced 503 million barrels of oil, and has approximately 800 million in reserves.

Lea County has been the predominant oil producer of the group for 20 years, and will retain this position indefinitely in view of the success gained from the long-deferred exploration of deeper producing horizons. This county has 38 oil fields, and five small depleted areas that have accounted for 453,225,169 barrels of oil from 138,000 developed acres. About 72 percent of the 3455 oil wells produce by natural flow. Several fields that originated in Lea County have been extended into Chaves and Eddy counties. Half of the Cap Rock field falls within the borders of Chaves County.

Crude reserves in Lea County have resumed an upward trend after years of lagging development of proved acreage and prospecting by reason of curtailed transportation and market outlet. The county entered the midyear period with crude reserves calculated at 745,429,000 barrels. Further gains will materialize as deep explorations expand.

Lea County derived all of its oil production from the Permian beds down to the San Andres limestone prior to 1944.

Three deep-pay oil strikes occurred in 1944. The Drinkard field, which has been expanded into a 5640-acre oil area, made its appearance in October, 1944, from the 6500-foot Yeso, or Clear Fork. This oil zone is locally identified as the Drinkard pay. Other oil zones above and below have since been established within the field, but are small in area. The Drinkard field is subject to major extensions, particularly on the north end. First Ellenburger production for the state was recorded in November through the completion of the Dublin field discovery, which was abandoned in January, 1947, after producing 38,847 barrels of sweet crude. Excessive water with the oil caused early abandonment, while later tests to the north and southeast registered sharp structural dip. The third deep strike for the year was made in December through the completion of the county's first Pennsylvanian (Strawn) producer to open the Cass field, which has three flowing wells.

A substantial addition to the county's reserves has resulted in the discovery of the Paddock field in April, 1945, from the 5200-foot Glorietta, or first prospective producing zone below the San Andres. This field has since expanded west and northwest to cover 3080 productive acres. More extensions are in the making. The Blinebry and Harrison areas also were uncovered in 1945, but have not attained importance.

Ellenburger pay in the Brunson field will yield an average of 25,000 barrels per acre, or the highest forecast for any zone in the state. Completions average 76 feet of exposed pay, but few wells are producing from the full pay section. Some wells have been completed from extremely porous granite-wash beds encountered immediately below the dolomite, reserving the oil content of the latter for later years. Flowing production from the Simpson has been indicated by some tests in drilling to the Ellenburger, making a total of five oil pays in a given area. The drilling of multiple locations on a 40-acre unit has become routine.

The consolidated Eunice-Monument field, embracing 40,000 developed acres, will be the next among the older fields to stage a revival of drilling. A projected Ellenburger test at the apex of the Permian producing structure of the original Monument sector passed up prolific oil flow from thick beds of Glorietta (Paddock) lime. The underlying Blinebry zone showed some prospect for oil production, while the Yeso had not been explored at the close of June.

Large-scale development of regular Permian dry gas areas, which has been sparsely drilled, will get under way to support the 24-inch gas transmission line to California when casing becomes available.

The northeast corner of Lea County will provide the next major development of San Andres oil production. The single producer in the Sawyer pool is the forerunner of an expansive oil area. Outlying failures that preceded this strike lacked adequate oil porosity above the water table to make commercial wells, but production will be developed close to and in some instances beyond these failures. Structural conditions are somewhat similar to the Slaughter and Levelland fields to the east in Texas.

INTERNATIONAL CRAWLERS
Push Up Your Profits

THIS International TD-14 Diesel moved more than 5,000 yards of earth in 35 hours of operation—more than 135 yards an hour—with a minimum fuel consumption.

Owned by the Monarch Construction Company of Oklahoma City, this International is one of two TD-14's operated by the company. "They're highly satisfactory and we're mighty proud of them" is the way Monarch speaks of its Internationals.

These statements are just more evidence of the all-around satisfaction you get from International Diesel Crawlers. They're built for honest service and perform at lowest fuel and operating costs.

Let your International Industrial Power Distributor give you the answers to your power problems. He'll show you how your dollars will produce more profit with International Power.

Industrial Power Division

INTERNATIONAL HARVESTER COMPANY

180 North Michigan Avenue — Chicago 1, Illinois

Earl Reynolds, operator of this tractor, says, "I've operated a lot of competitive crawlers and I like Internationals best. I had no maintenance at all in two years of operation on a TD-14."

INTERNATIONAL HARVESTER

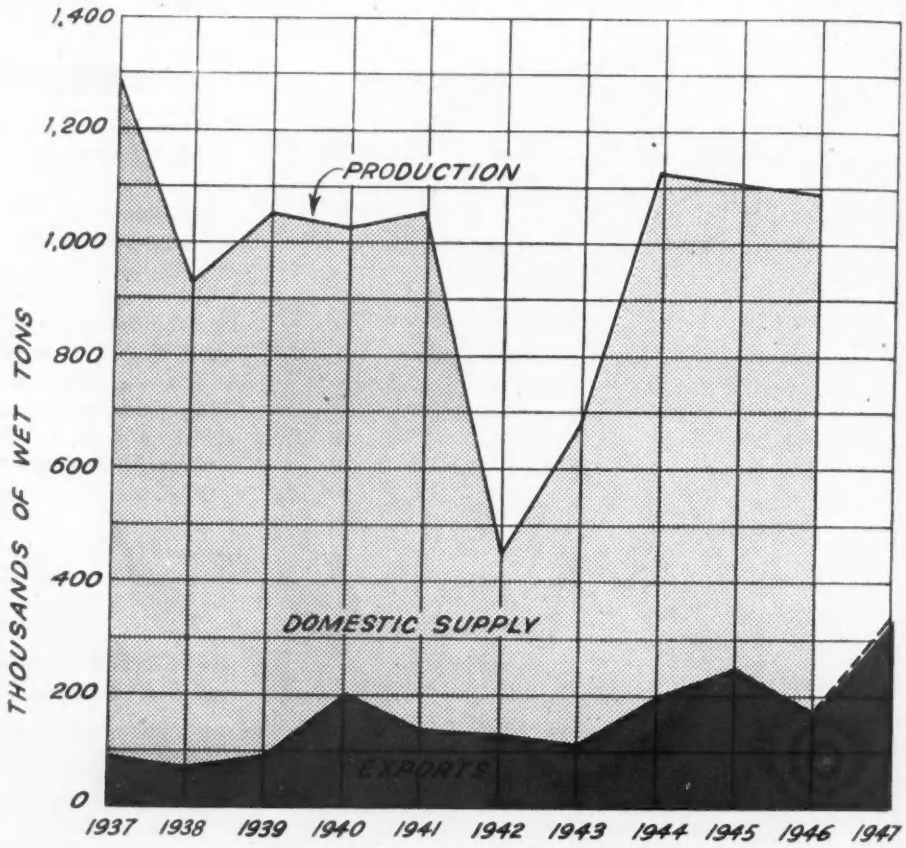
INTERNATIONAL POWER

CRAWLER TRACTORS • WHEEL TRACTORS • DIESEL ENGINES • POWER UNITS

PETROLEUM STEEL NEEDS UP SHARPLY . . .

By
WARREN L. BAKER
Editor

TO PROVIDE adequate supplies, industry must expand development rates in proportion to gain in consumption. To do this, 40,000 wells should be completed in the United States this year instead of expected 35,000. With drilling operations abroad much greater than heretofore, requirements for U. S. manufactured tubular goods has increased to somewhere close to twice the prewar average of one million tons annually.



U. S. PRODUCTION AND EXPORT OF TUBULAR GOODS
Postwar production of tubular goods has been slightly greater than prewar average, but increased exports have left domestic operators with smaller supplies.

FOR the first time in peacetime history, the petroleum industry is finding it difficult to increase its supply of products rapidly enoungh to meet mounting consumer requirements.

The situation is not due to any scarcity of crude.

Facts do not justify any impressions that this country faces an oil shortage.

The present plight of the industry is but the natural and obvious result of wartime limitations on drilling and facility construction, plus the shortage in steel equipment which continues to hold back postwar expansion at a time when exceptionally large increases have occurred in petroleum consumption.

From an address before the annual meeting of the Independent Petroleum Association of America, Oklahoma City, September 30.

To provide adequate supplies for expanding consumption, it is necessary that more wells be drilled to increase producing ability, that new pipe line systems be built to handle greater volumes needed today, and that new refining facilities be constructed to convert larger quantities of crude into usable products for consumers.

The industry is making a most determined effort to enlarge its capacities sufficiently to meet the situation. Under way is the greatest expansion program in history. During 1947 and 1948, more than $4 billion will be spent in the U. S. alone. The magnitude of this program is hard to grasp, for it involves the expenditure of an amount exceeding one-fifth of the total investment made by the industry to date.

The factor which seriously dims the industry's hope of fulfilling its heavy responsibilities is the inability to procure sufficient quantities of steel to complete expansion plans in time to meet consumer requirements. The industry is being asked to produce one third more crude oil with practically the same amount of steel used before the war. Prewar quantities of steel simply are not sufficient to keep the industry's development pace in tune with current higher production, transporting, and refining needs.

Material at Prewar Level

Oil country tubular goods (casing, drill pipe and tubing) constitute the largest portion of the pipes and tubes used by the industry. Statistical records of the American Iron and Steel Institute show that the industry has been receiving

practically the same amount as before the war. Hence, drilling activity has been limited to prewar rates at a time when the industry is striving to drill a much larger number. Production of oil country tubular goods averaged 1,069,794 tons annually in the five prewar years (1937-1941) and production in 1946 was 1,094,962 tons.

Increased exports have aggravated the tubular goods shortage, further reducing the quantity available to domestic operators. Unfortunately, statistical records on exports of steel do not separate shipments of line pipe and casing, but the major portion of these exports assuredly consists of casing, since few foreign pipe lines have been constructed in the period under consideration. Therefore, relatively correct figures on volumes available domestically can be obtained by subtracting export shipments of line pipe and casing from production of tubular goods.

Department of Commerce statistics show that less than 125,000 tons of casing and line pipe were exported from the U. S. during the prewar years of 1937-1941. Thus, more than 90 percent of the tubular goods manufactured was used in the U. S. Last year's output of oil country tubular goods was slightly greater than in the prewar annual average; nevertheless, the domestic industry suffered a reduction in available supply because of increased exports. The U. S. in 1946 shipped 179,000 tons of tubular goods overseas, an increase of 47 percent over prewar average, leaving domestic operators with an indicated total of 915,179 tons, in contrast with an annual average of 948,335 tons in the five prewar years.

Exports Increasing

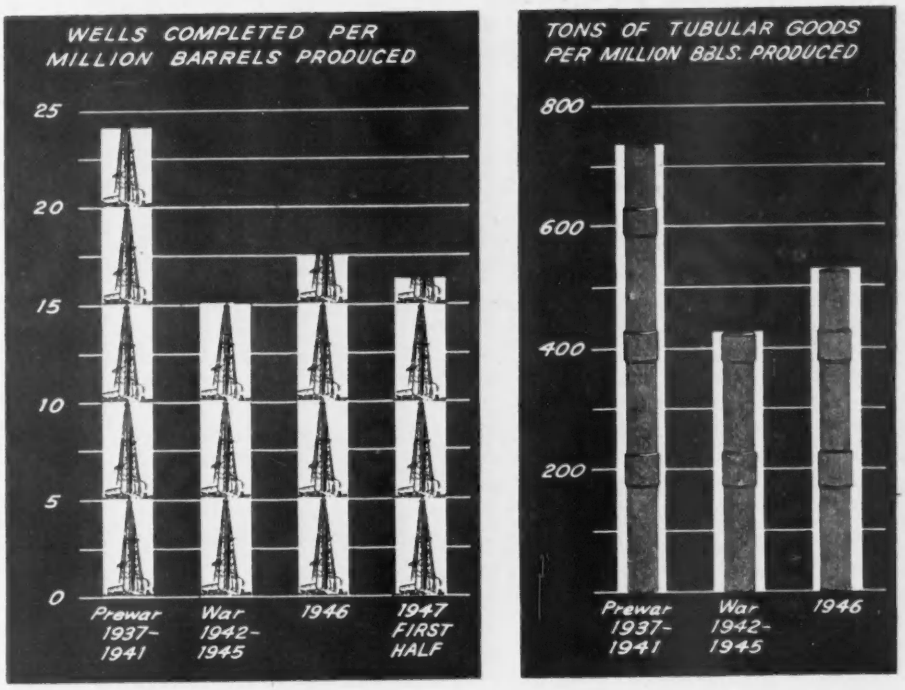
Exports during 1947 have increased more sharply, amounting to 166,293 tons during the first six months, which is an 85 percent gain over last year and 173 percent larger than in the 1937-1941 period. This volume was equivalent to the completion of 4750 wells in the U. S. Figures on the amount of tubular goods made during the first half of 1947 are not available. However, on the reasonable assumption that the production of tubular goods will maintain its relationship to total steel output, it is indicated that an all-time record of 1,400,000 tons may be manufactured. Nevertheless, at the first half year export rate, the supply of tubular goods available in 1947 for domestic use would increase but 150,000 tons, although production may rise 300,000 tons. In other words, the indicated increase in tubular goods production is being divided almost equally between domestic and foreign operators.

This increase in tubular goods shipped abroad has occurred as a result of the government's attempt to supply foreign industry. The government has even permitted a considerable quantity of the tubular goods exported to go to countries where U. S. nationals have either no interest or very small oil holdings. For example, Mexico, Russia, and Argentina received 143,746 tons during the past 2½ years, which is equivalent to the drilling of nearly 4000 wells in the U. S.

Some relief for domestic operators from excessive exports may be in sight. Effective October 1, individual licenses will be required for all exports of oil well casing and line pipe. In recent past months, export shipments have been made under consolidated licenses. Under individual licenses, exporters will be required to apply separately for each item to be shipped and to show the use to which the commodity is to be put.

As a result of receiving only normal prewar quantities of tubular goods, U. S. oil operators have been able to obtain a much smaller volume of steel in relation to production demands imposed upon them. During the prewar years (again 1937-1941) the production of oil country tubular goods was such as to provide for exports and leave domestic operators with a supply equivalent to 735 tons for every million barrels of crude produced. This decreased to 425 tons per million barrels of production during the war (1942-1945), and increased to only 528 tons per million barrels of production in 1946.

U. S. Drilling and Steel Supplies vs. Production



In proportion to production rates, a subnormal number of wells are being drilled in the U. S. This reduction is in direct relation to the amount of tubular goods available to domestic operators.

Limited Drilling

This reduction in steel has forced the industry to limit its drilling to a subnormal number of wells in relationship to its production rate. One thousand fewer wells were completed in 1946 than the annual average for the five prewar years (1937-1941), although production was one third larger. During the prewar period, an average of 24.2 wells was completed for every million barrels of crude oil produced. This dropped to 15.1 new wells per million barrels produced during the war years, and recovered to only 17.4 new completions for every million barrels produced during 1946. Despite an increase in number of wells completed during the first six months of 1947, crude production continued to outstrip completions by an ever-widening margin. Only 16.4 new wells were completed for each million barrels of oil produced during the first half of 1947.

It is significant that drilling and the quantity of oil country tubular goods available domestically in 1946 both declined 3 percent from prewar levels.

It is unlikely that the U. S. petroleum industry currently would be drilling as many wells for every million barrels produced as it did before the war. Due to more general use of wider well spacing, the rate of completing wells probably would be something on the order of 22 wells annually per million barrels produced instead of 24. On this basis,

the industry should have drilled 38,000 wells in 1946 instead of the 30,221 actually completed; and should complete 40,000 in 1947 instead of the expected 35,000 completions.

To complete 38,000 wells in 1946 would have required about 1¼ million tons of oil country tubular goods. In contrast with this need, the steel industry last year made only slightly more than 1 million tons for both domestic and export shipments, leaving the domestic industry nearly 350,000 tons short of requirements. On the basis of 735 tons of tubular goods per million barrels of oil produced in prewar years, statistics again indicate that an additional 350,000 tons of casing, drill pipe and tubing should have been manufactured in 1946 to reestablish a proper drilling relationship with production rates.

In behalf of the steel industry, which has been doing a far better job than it is generally given credit for, it should be pointed out that strikes caused the loss of nearly two months during 1946. In terms of tubular goods, these strikes accounted for half of the 350,000-ton domestic shortage, or 5000 new wells.

Indications are that production of steel in 1947 will total more than 85 million tons, greatest in peacetime history and almost equal to the all-time peak reached in the war year of 1944. This record output, as mentioned previously, may result in production of tubular goods reaching an all-time high of 1,400,000 tons during the year. This would be sufficient for the industry to restore drilling to prewar relationship with production (40,000 wells annually) if it were not for exports.

Steel Needs Higher

In comparison with previous rates, the completion of 40,000 wells annually seems high. But closer scrutiny indicates such a rate of drilling activity would not be excessive or unlikely under conditions confronting the industry today. There should exist a close relationship between the growth in production and the gain in number of producing sources, and between 1937 and 1941 the number of producing oil wells and crude production in the U. S. both increased 10 percent. However, between 1941 and 1946, the output of crude rose 23 percent and there was only a 6 percent growth in the number of producing oil wells.

With present production nearly equal to the maximum ability of existing wells, it is imperative that drilling rates provide enough new producing wells to yield the additional output that certainly will be required. If the industry were completing 40,000 wells this year, instead of the expected 35,000, the number of producing oil wells probably would increase but 4 percent, the minimum gain anticipated for production. On this basis, the drilling of 40,000 wells annually does not seem excessive, or unlikely.

It must be recognized that drilling operations abroad henceforth are to be at levels several times higher than before, and that much of the tubular goods for foreign operations will be purchased in the U. S. This fact, coupled with prospective greater U. S. drilling rates, indicates that demands for tubular goods have increased to somewhere close to twice the prewar annual average of 1 million tons.

Allocations High

It should be pointed out that the oil and gas industry has received relatively larger supplies from the steel industry than some other businesses which are also clamoring for steel products. Shipments of all types of finished steel products to the oil and gas industry in 1946 amounted to 4.1 percent of all shipments, somewhat larger than the 3.6 percent given to the industry in 1940. In contrast, the important automotive industry last year received but 12.5 percent, whereas it was shipped 15.7 percent of all finished steel shipments in 1940. The important construction and railroad industries also received smaller steel shipments in 1946 than in 1940.

The situation with respect to supplies of line pipe is even more critical than that regarding tubular goods. The industry's most acute immediate need to meet consumer requirements is additional transportation facilities. This fact, coupled with an amazing growth in demand for natural gas, has resulted in the greatest pipe line construction boom in all history.

Under construction or actually planned is the building of nearly 30,000 miles of new pipe lines during 1947-1949, an amount two times greater than the 15,000 miles constructed during the three prewar years of 1939 through 1941. About 24,000 miles of the above figure will be constructed in the U. S. Orders for line pipe already have booked U. S. mill capacity through 1950, although additional pipe lines undoubtedly will be planned during the interim.

A factor which intensifies the industry's pipe line position is the shift to larger diameter systems. While natural gas lines of 24-inch were laid before the war, today 26, 30 and even 36-inch gas systems are being constructed. At the same time, crude oil lines, which before the war did not exceed 12 inches in diameter, now include approximately 1700 miles of 20-inch pipe and 1000 miles of 30-inch. Sufficient mill capacity for rolling plates into such large diameter pipe is not available.

All studies of the situation lead to the single conclusion that the petroleum industry's requirements for steel products, both in the U. S. and abroad, have increased very sharply and unquestionably will remain above prewar annual averages. The U. S. petroleum industry must drill a larger number of wells than before the war to keep its producing ability abreast of enlarged production rates, and foreign drilling certainly is to be much greater than before the war.

If strikes do not prevent the steel industry from continuing to produce in record volumes, it is expected to catch up with some of its steel demand by mid-1948. This would permit steel mills to divert more of their production to products used by the oil and gas industry. Consequently, prospects are that the quantity of steel available for drilling and pipe line work will be larger in the near future. But when steel supplies will be sufficient to fully satisfy demand is still problematical.

United States Drilling and Steel Supply Trends

	Crude Production (Millions of Barrels)	New Wells Completed (Including Input but Excluding Wells Deepened)	No. of Wells Completed per Million Barrels Produced	U. S. Production of Oil Country Tubular Goods (Net Tons)	U. S. Exports of Casing and Line Pipe (Net Tons)	U. S. Production Of Oil Country Tubular Goods Less Exports of Casing and Pipe (Net Tons)	Oil Country Tubular Goods Available in U. S. per Million Barrels Produced (Net Tons)
First Half 1947	889	14,582	16.4	n.a.	166,293	n.a.	n.a.
1946	1,733	30,221	17.4	1,094,962	179,783	915,179	528.1
1945	1,711	26,649	15.6	1,117,793	256,770	861,023	503.2
1944	1,678	25,786	15.4	1,126,705	199,034	928,087	553.1
1943	1,506	20,349	13.5	674,576	113,922	561,342	372.7
1942	1,386	21,990	15.9	457,603	136,826	320,777	231.4
Average 4 War Years	1,570	23,694	15.1	844,169	176,638	667,807	425.4
1941	1,401	32,510	23.2	1,050,643	141,948	908,695	648.6
1940	1,353	31,149	23.0	1,028,410	203,447	824,963	609.7
1939	1,265	28,012	22.1	1,050,083	98,455	951,628	752.3
1938	1,214	29,127	24.0	935,297	71,347	863,950	711.7
1937	1,217	35,045	28.8	1,284,536	92,098	1,192,438	979.8
Average 5 Prewar Years	1,290	31,169	24.2	1,069,794	121,459	948,335	735.1

n.a.—Data not available. Steel production figures from American Iron and Steel Institute. Steel export figures from U.S. Department of Commerce.

Drilling Contracting Situation

By RAY L. DUDLEY
Publisher

WITH 80 percent of all oil wells in the U. S. now being drilled under contract, and the trend definitely toward a greater percentage, the oil-producing industry has a distinct stake in seeing the drilling contracting business maintained as a healthy arm of the oil industry. Unfortunately, the drilling contracting business is not in a healthy state.

Briefly, the situation is that since 1941 the drilling contractor's costs have increased roughly 40 percent. He has been able, by increased efficiency in crews and equipment, to drill 15 to 20 percent faster than in 1941, but he is receiving for his work just about what he did in 1941, a year of low drilling contractor prices.

The foregoing conclusions are based upon information which WORLD OIL has every reason to believe is reliable.

For instance, in the matter of drilling costs for the U. S. on the whole, labor is up 35 percent; equipment cost is up 30 percent, and miscellaneous expense is up 60 percent, with daily operating cost (rig as a unit) being up 40 percent on an average.

For the U. S. as a whole, revenue per foot drilled in 1947 is 1 percent lower than it was in 1941.

It is true that in the U. S. as an average, the "rate of penetration" (speed of drilling) has increased by 15 percent (and in some areas more), but this has been accomplished at considerable extra expense.

Today in many difficult drilling operations contractors are using a six man crew, something unheard of in 1941. Too, today, it is a rare thing that a crew is laid off during cementing operations.

With reference to the contractor's price per foot, it should be remembered that drilling has been going deeper and deeper, and that while the rate per foot on some deep holes is greater than in 1941, the increased price has not kept pace with the increased cost.

A breakdown of the drilling costs by areas is very interesting. For instance:

In the Permian Basin:

	1941	1947
Labor	100%	137%
Equipment	100%	131%
Miscellaneous Expenses	100%	161%
Daily operating costs (Rig as a unit)	100%	141%
Revenue per foot drilled	100%	98%
Rate of penetration	100%	125%

In the Oklahoma-Kansas area:

	1941	1947
Labor	100%	130%
Equipment	100%	130%
Miscellaneous expenses	100%	155%
Daily operating costs (Rig as a unit)	100%	137%
Revenue per foot drilled	100%	99%
Rate of penetration	100%	120%

On the Texas-Louisiana Gulf Coast:

	1941	1947
Labor	100%	134%
Equipment	100%	131%
Miscellaneous expenses	100%	162%
Daily operating costs (Rig as a unit)	100%	141%
Revenue per foot drilled	100%	102%
Rate of penetration	100%	120%

In California:

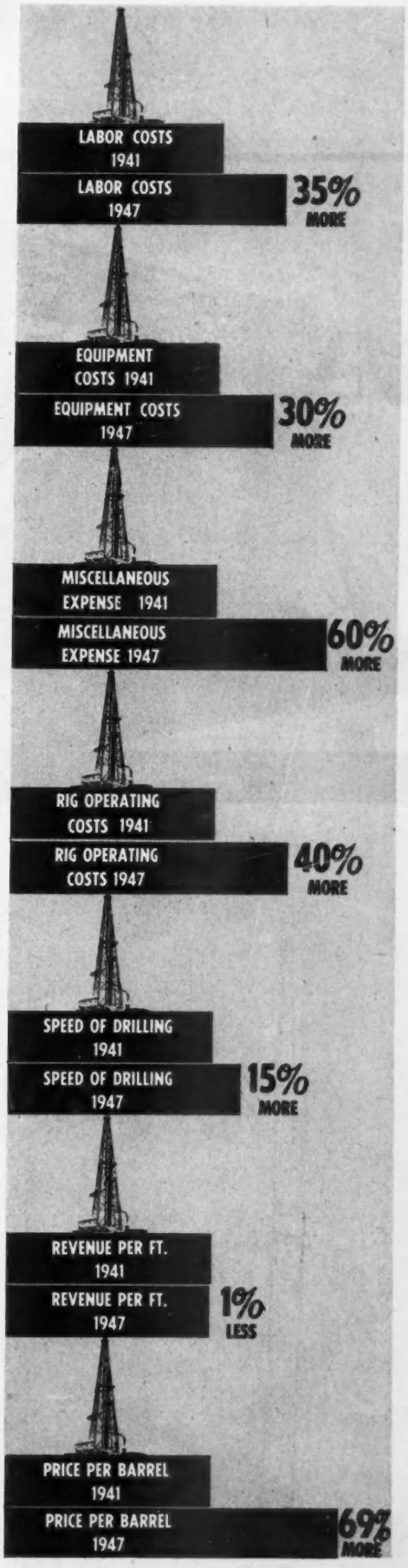
	1941	1947
Labor	100%	136%
Equipment	100%	132%
Miscellaneous expenses	100%	158%
Daily operating costs (Rig as a unit)	100%	140%
Revenue per foot drilled	100%	98%
Rate of penetration	100%	115%

While this has been happening in the drilling contracting business, the expense of finding and producing oil has been going up, also. But the income to the producer on crude oil has gone up 69 percent.

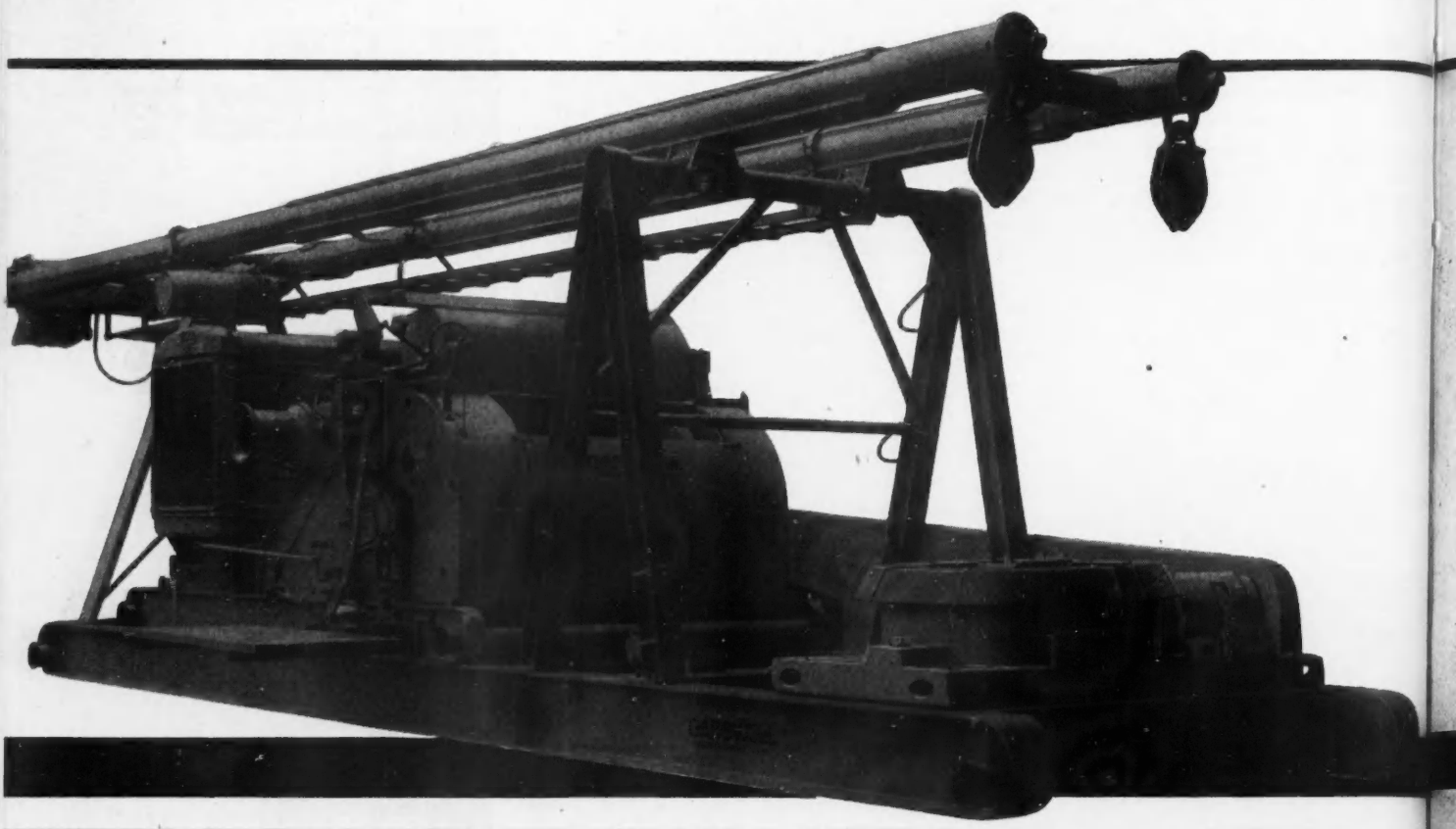
Why the difference in the economic status of the man who drills for the oil and the producer of that oil?

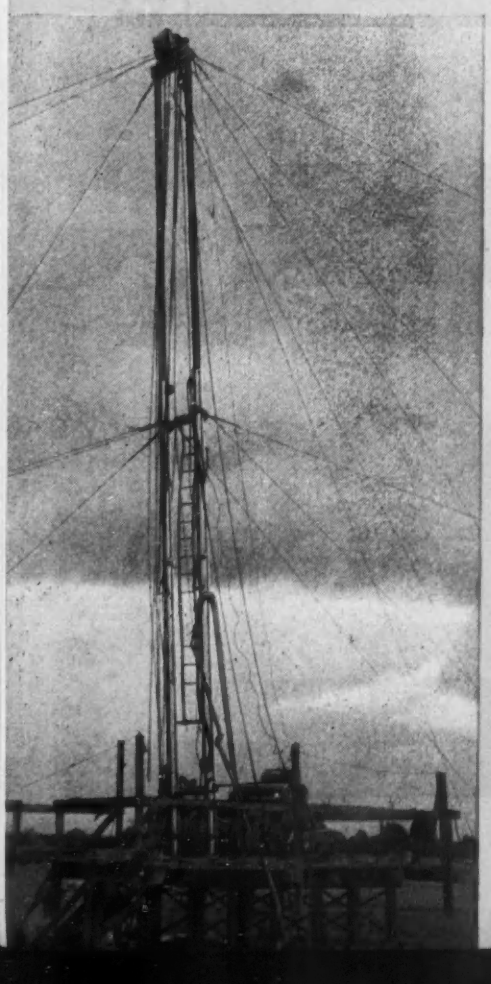
There seems to be some significance in the fact that deep hole drilling has gone up in price while medium and shallow drilling actually is done for less than in 1941. The answer probably lies in the fact that there are not as many heavy duty rigs competing for the job, plus the possible further fact that the contractor with the heavy duty, highly expensive rig, may keep closer tab on his costs than the contractor doing the less difficult job.

In other words, it would appear that much of the trouble lies among the contractors themselves in taking work at less than its cost. This is done in some instances because the contractor may figure that it costs him a certain amount to have a rig standing idle, and he knows that if he discharges his crew he may have trouble getting men back, so he takes the job to keep the crew and the rig running as a temporary measure and finally finds his low price setting the rate for future work.



For Profitable
WELL SERVICING





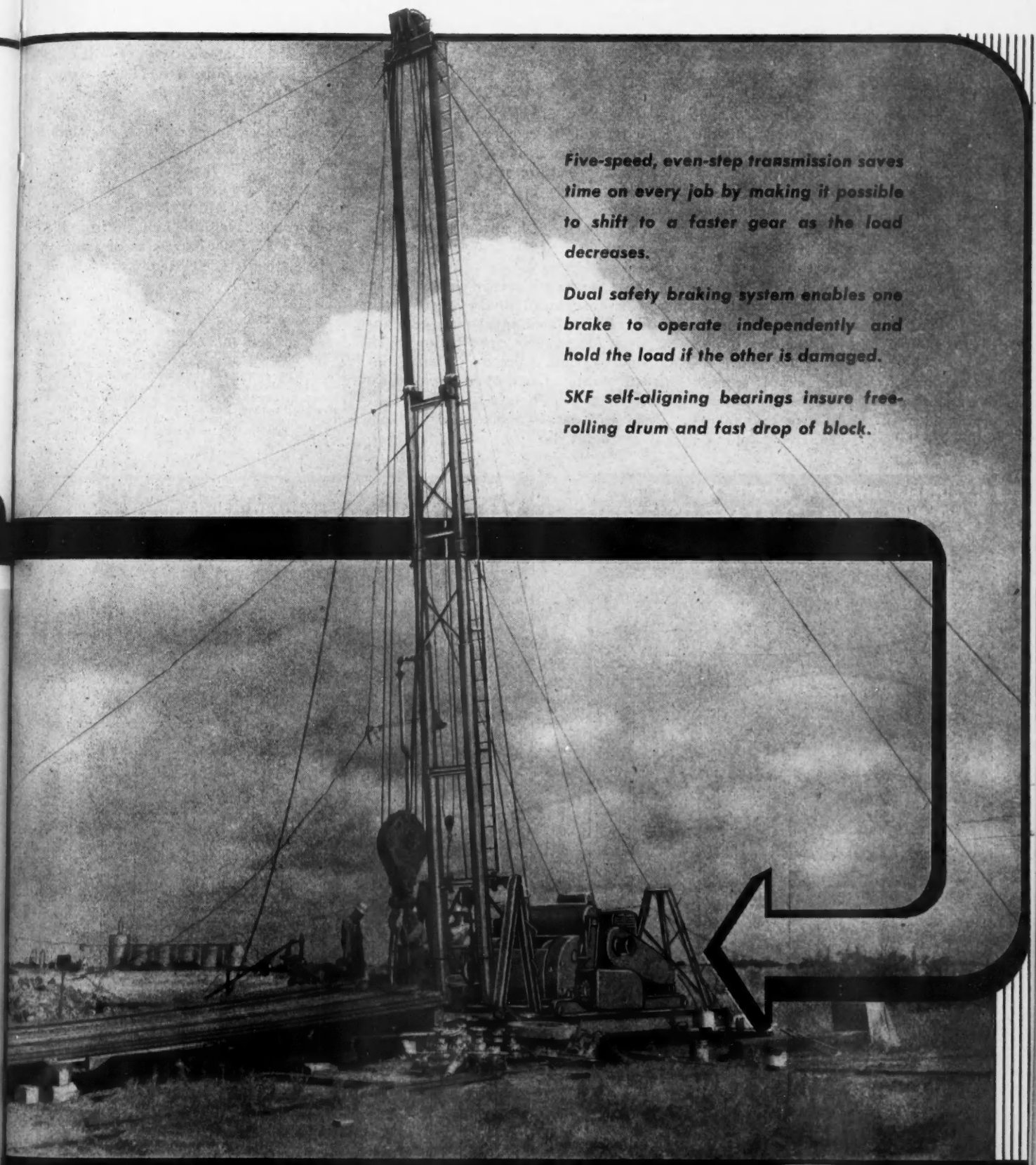
The "Cardwell" Model S hoist shown above is equipped with rotary table drive assembly, and is mounted on subframe with rotary table and 55- or 65-foot double leg mast.

This complete rig is recommended for rotary workover jobs using tubing or lightweight drill pipe.

Three smaller sizes, Models Q, H and K, are available for well servicing from 2,000 to 6,500 feet. All hoists are available with single or double leg masts, and Models H, K and S with rotary drive assembly.

Model K hoist with 55-foot double leg mast swabbing a 4,869-foot well.

G USE A "CARDWELL"



Five-speed, even-step transmission saves time on every job by making it possible to shift to a faster gear as the load decreases.

Dual safety braking system enables one brake to operate independently and hold the load if the other is damaged.

SKF self-aligning bearings insure free-rolling drum and fast drop of block.

CARDWELL ALL STEEL
REG. U.S. TRADE MARK PAT. OFFICE
THIS TRADE MARK INSURES HIGHEST QUALITY AT LOWEST PRICE

CARDWELL MFG. CO. INC.

P. O. Drawer 2001 . . . Long Distance Telephones 128 – 129 – 130
Cable Address: "ALL STEEL," Wichita — "CARDSTEEL," New York
Wichita, Kansas, U. S. A.

"CARDWELL" RIGS ARE STRONGER, WEAR LONGER AND WEIGH LESS

Vigorous Refinery Expansion Needed

By L. J. LOGAN
Associate Editor

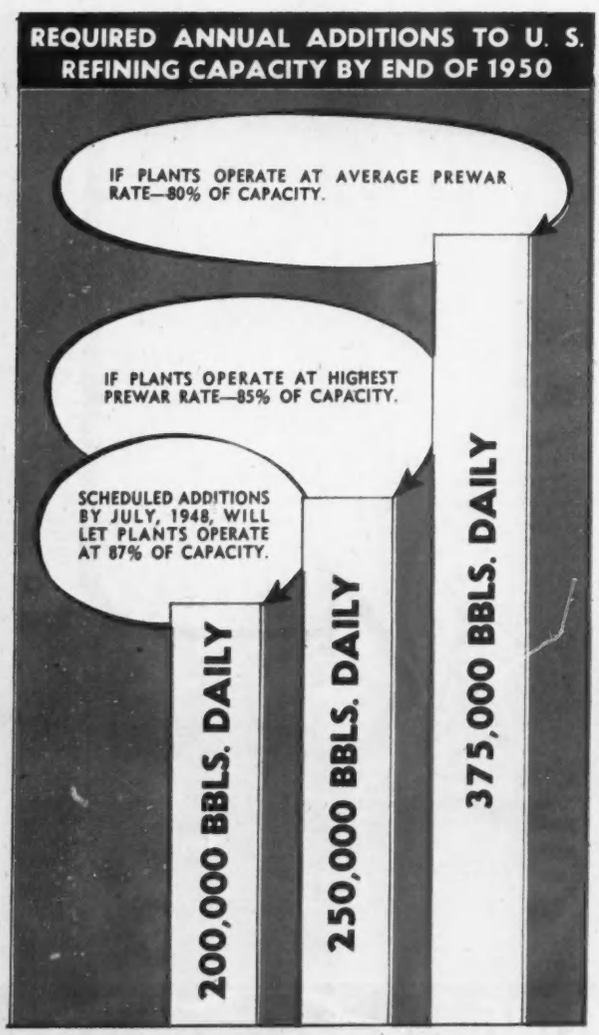
THE refining branch of the U. S. petroleum industry is confronted with the necessity for a domestic plant building program beyond present plans.

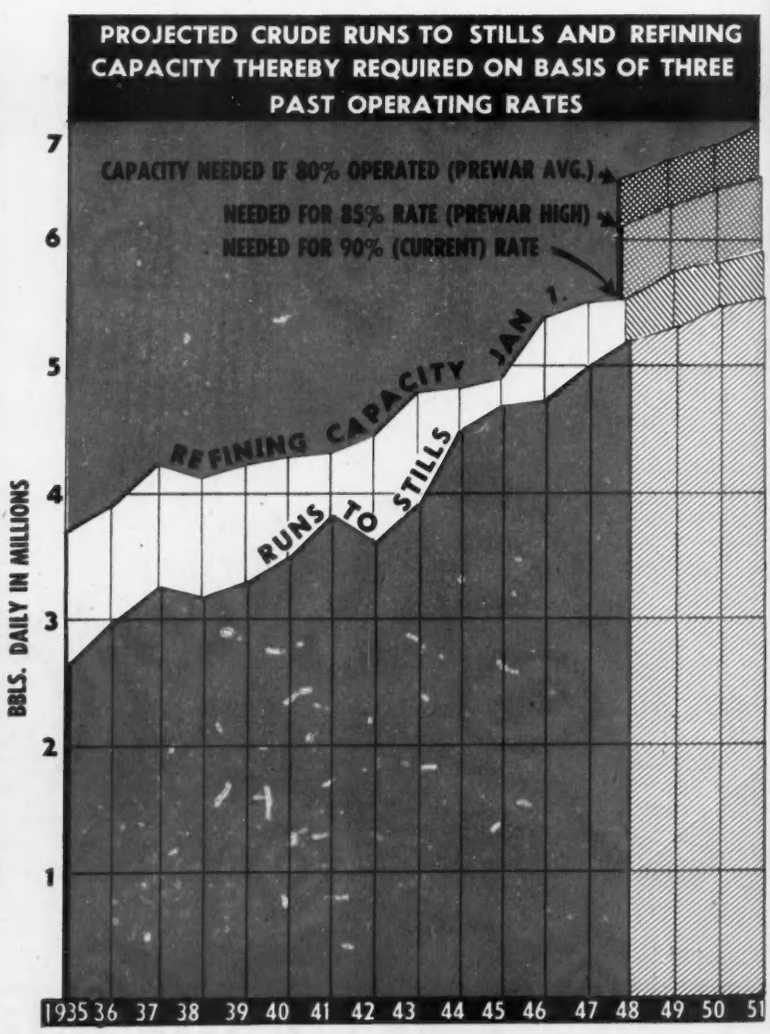
This is indicated by a study of demand trends and refinery capacities and practices. Even if refining plants at the end of 1950 are to operate at the highest prewar rate of 85 percent of their potential, as was the case in 1941, it will be necessary to build 250,000 barrels per day of additional net crude charging capacity annually during the next three years. This figure is over and above replacements for obsolete units. If refining operations are restored to the normal prewar level of using 80 percent of capacity, an average annual net addition of more than 375,000 barrels in daily capacity will be required within three years (which is as far as this study attempts to go). Currently, the margin of unused capacity is extremely thin, as plants are pushed to more than 90 percent of capacity and substantial amounts of marginal, inefficient capacity are employed.

These indicated needed increases in capacity are substantially more than those contemplated in plans so far announced for refinery construction. Such announced plans indicate an annual construction rate of approximately 200,000 barrels daily of new capacity, part of which will merely replace existing old equipment. It should be added, however, that the total announced construction could be increased materially overnight, bringing the industry's actual plans closer in line with indicated needs, as plans for refinery expansion usually are not made public until contracts for projects have been awarded.

To provide the 5,225,000 barrels per day of refinery runs estimated for 1948 by operating at the prewar average rate of 80 percent of January 1, 1948, capacity would require the existence at that time of 6,531,000 barrels per day of capacity instead of the 5,771,000 barrels expected to be available. Figured on the 80 percent operating rate, there will be at the beginning of 1948, therefore, a deficiency of 760,000 barrels per day of capacity. If the industry were to eliminate this deficiency gradually in 1948, 1949, and 1950, then the capacity itself would have to be built up from the expected 5,771,000 barrels as of January 1, 1948, to 6,937,000 barrels daily as of January 1, 1951.

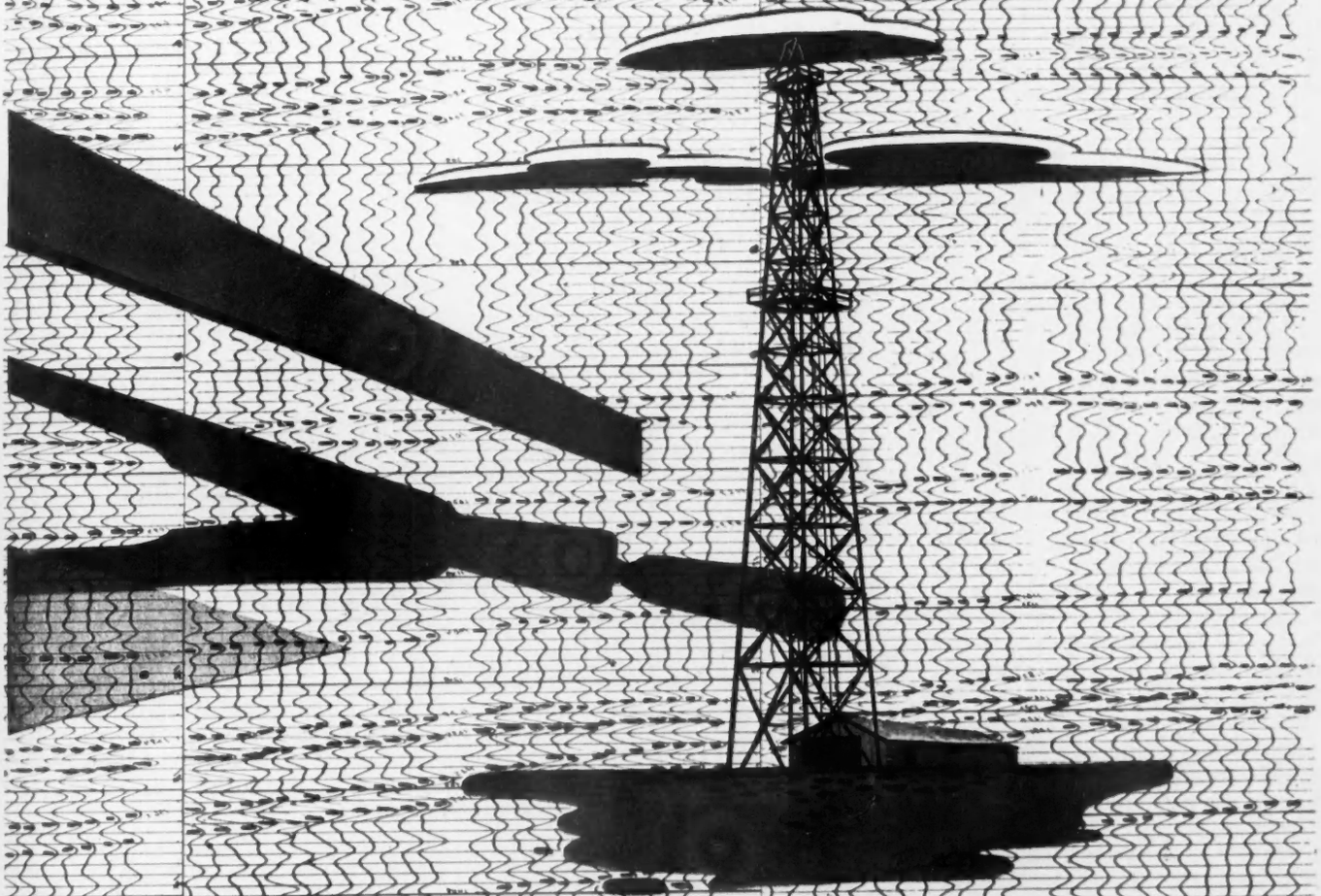
Author's Note: Sources of information for the foregoing article are comments by national figures in oil, replies to letters, a special release by API on prospective expenditures, U. S. Bureau of Mines reports on runs to stills. API estimates on past refining capacities and WORLD OIL's own research into prospective demand. Conclusions are the author's. A complete article of three pages, embracing tables, and specific quotations mentioned above, will be found in the October issue of *Petroleum Refiner*.


REQUIRED ANNUAL ADDITIONS TO U. S. REFINING CAPACITY BY END OF 1950
IF PLANTS OPERATE AT AVERAGE PREWAR RATE—80% OF CAPACITY.
IF PLANTS OPERATE AT HIGHEST PREWAR RATE—85% OF CAPACITY.
SCHEDULED ADDITIONS BY JULY, 1948, WILL LET PLANTS OPERATE AT 87% OF CAPACITY.
200,000 BBLS. DAILY
250,000 BBLS. DAILY
375,000 BBLS. DAILY


PROJECTED CRUDE RUNS TO STILLS AND REFINING CAPACITY THEREBY REQUIRED ON BASIS OF THREE PAST OPERATING RATES
CAPACITY NEEDED IF 80% OPERATED (PREWAR AVG.)
NEEDED FOR 85% RATE (PREWAR HIGH)
NEEDED FOR 90% (CURRENT) RATE
REFINING CAPACITY JAN 1.
RUNS TO STILLS
BBLS. DAILY IN MILLIONS
1 2 3 4 5 6 7
1935 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51

Oil is Found!

Exploration for oil has now covered much of the world, yet new pools are consistently being discovered in areas previously overlooked. Credit must go to the scientists and engineers, the men who use the most modern methods of determining where oil may be found. Today, oil is discovered on the drawing board, in the laboratory, in the field equipment and interpretation offices of the technicians utilizing precision seismic surveys to indicate sub-surface formations.



Century

Geophysical Corporation

Tulsa, Oklahoma

Oklahoma SHOWS THE WAY!

By ANTHONY GIBBON

Staff Writer

EFFECTIVE OCTOBER 1, lease lines disappeared in the 30,000-acre West Edmond pool as an operators committee took over to operate it as a unit. In this act which was not altogether unopposed, engineers accepted a challenge designed to show the oil-producing industry as well as the owners of mineral rights that the best way to get the most oil and make the most money from a common source of supply is to operate it as a whole, instead of subdividing it into many parts. Much depends upon the outcome of the project. Perhaps the most important issue is whether the industry will adopt "engineered production" practices on a wide scale.

WHEN the Oklahoma Corporation Commission approved an application and issued an order for the unitized operation of the West Edmond Hunton lime pool it took a very progressive step in conserving the nation's oil and gas resources. The 30,000-acre pool in central Oklahoma went under unit operation October 1 as the first field ever unitized by compulsory communization of all lease and royalty owners. The order was issued to provide for most efficient production and greatest oil and gas recovery while protecting the equity of tract owners. The step further serves to emphasize the growing trend in the oil industry toward real conservation of the nation's petroleum resources.

Paralleling closely successful unitized operations of such major oil and condensate fields as Haynesville, Cotton Valley, Bateman Lake and Erath in Louisiana, Elk Basin in Wyoming, and Jones-Schuler and Magnolia in Arkansas, the action of the Oklahoma Corporation Commission marks another forward step along the path of "engineered production." Leaseholders and royalty owners are realizing more than ever before that unitization offers the only real protection of correlative rights and that it is the only means of insuring complete protection for such rights by enabling competent petroleum engineers to establish factual equity distribution and to adapt, unhampered from outside interference, the best operating techniques applicable in any given area. If applied early enough, "engineered production" usually assures a higher rate of oil recovery and prolongs the economic life of an oil reservoir.

Under the commission order of July 29, a program was arranged which will permit operation of the entire field as a single unit, under single management, and for practical operating purposes obliterating all lease lines. Such operation is authorized by a 1945 Oklahoma statute, the first law of its kind enacted in any oil-producing state.

The success or failure of the West Edmond unit will have a decided influence on future production policies of the industry. From the legal standpoint the outcome of the program will have an important bearing on the advisability of granting to state regulatory bodies the power of issuing mandatory unitization orders whenever they deem such procedure necessary and in the best public interest.

From the engineering viewpoint, success of the West Edmond unit will demonstrate that the best defense against wasteful depletion of an oil reservoir lies in direct attack on the problem during the early producing stage of a reservoir.

Unlike other areas which have been unitized voluntarily for operating purposes, West Edmond is a comparatively new pool and its reservoir behavior has been under close observation and study by petroleum engineers and operators since its discovery. Need for definite action to restrict wasteful depletion of primary energy within the reservoir was manifested shortly after bottom-hole pressure tests and gas/oil ratio surveys indicated an alarming trend towards a premature termination of the economic life of the pool.

Faced with this problem, a majority of operators at West Edmond organized an engineering committee to study reservoir behavior and recommend remedial measures designed to halt rapidly declining bottom-hole pressures and to keep gas/oil ratios down to a minimum. The committee, after months of careful study, submitted a report which declared that only by selective well production and probably by injecting gas into the formation could the danger of premature abandonment and loss of millions of barrels of oil be averted. The committee further emphasized that this could be done successfully only by operating the pool as a unit and by recognizing it as a common source of supply. Since West Edmond is one of the largest single fields in the U. S., unitization posed an insuperable problem in obtaining consent from holders of correlative rights, including some 5000 royalty owners.

While the engineering study was in progress the Oklahoma legislature, appreciating the gravity of the situation at West Edmond and other fields, enacted a law giving the Oklahoma Corporation Commission authority to issue mandatory unitization orders in any producing area recognized as constituting a common source of supply where 50 percent or more of the operators so indicated.

The West Edmond Hunton lime pool was discovered about 4½ years ago and has the distinction of being one of the only two major oil pools discovered during the war years. It lies principally in northwestern Oklahoma County but extends half a mile west into Canadian County and into southeastern Kingfisher and southwestern Logan counties. It also is the first important Hunton limestone production to be developed in Oklahoma.

The huge reservoir is estimated to have contaned 600 million barrels of oil in place when it was first discovered. Engineers estimate that under original competitive production methods and due to the nature of the limestone reservoir, only 140 million barrels, or 23.3 percent of the original estimated oil in place, was recoverable. Selective well control followed by injection of gas into

Everywhere

you see drill pipe protected with

PATTERSON-BALLAGH LIPPED CASING PROTECTORS

Ringing of drill pipe by fluid action is practically eliminated. Mud cannot collect on the lipped top to corrode pipe while standing in the derrick. The lips and streamline shape prevent mud swirling and cutting into drill pipe in the hole. Patterson-Ballagh Lipped Protectors save *both* drill pipe and casing. Protect your entire string, today!

Specify

PATTERSON-BALLAGH

DIVISION OF BYRON JACKSON CO.

LIPPED CASING PROTECTORS

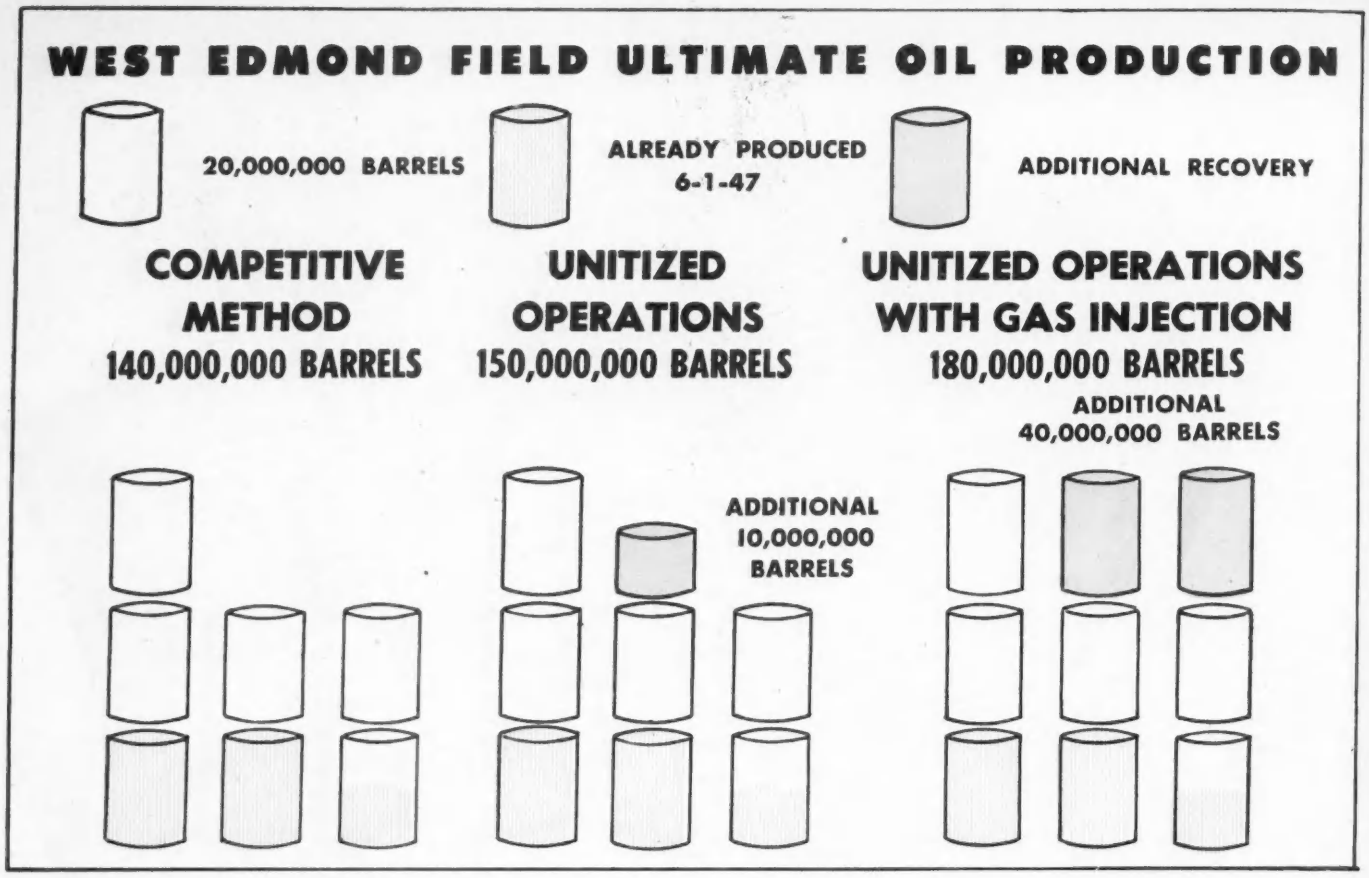
PATTERSON BALLAGH · SEAL OF QUALITY · OIL FIELD SPECIALTIES

Main Office:
1900 E. 65th St.
Los Angeles 1

★ 6247 Navigation Blvd.
Houston 11

★ 808 Graybar Bldg.
New York 17

★ 931 Russ Bldg.
San Francisco 4



the formation is expected to arrest declining bottom-hole pressures and to increase recovery between 40 and 80 million barrels (Figure 1). There is no appreciable water drive in the field, so that even if the maximum of 80 million barrels is recovered through repressuring . . . the only method proposed in the state order . . . there still will remain some 380 million barrels of residual oil. Don R. Knowlton, consulting engineer, estimated that an additional 30 million barrels of oil may be obtained by injection of water after gas injection has reached its effectiveness.

Pool History

The West Edmond pool was opened April 12, 1943. Wartime demand for crude oil resulted in an intensive drilling campaign with 143 rigs running at one time. The field was developed on 40-acre well spacing. Most wells, following acid treatment, flowed naturally and were pinched back to a 300-barrel-daily allowable which has been cut repeatedly following bottom-hole and gas/oil ratio tests. At one time allowables were cut down to 64 barrels per well. Today pool wells are producing 81 barrels and about 10 percent of the 777 producers, most of which produce water, are on the pump. On July 1, 1947, there were 739 Hunton limestone wells on the line, 34 Bartlesville sand wells, 1 Cleveland sand well, and 3 dual completions in the Bartlesville and Hunton zones.

Cumulative oil production to June 1, 1947, totalled 63,660,942 barrels from the Hunton (Devonian), and 980,477 barrels from the Bartlesville and Cleveland (Pennsylvanian) sand zones, or a grand total of 64,641,419 barrels . . . nearly half of the estimated total recovery of 140 million barrels. The pool attained its peak in September, 1945, when production was reported at 87,486 barrels daily. Present oil production totals approximately 39,000 barrels. Based on current withdrawals and without the benefit of repressuring through gas injection, some petroleum engineers estimate an economic life for the pool of approximately five years.

Concern for the economic life of the West Edmand pool was felt shortly after initial gas/oil ratio tests indicated that gas was rapidly coming out of solution and that unless unitization was effected within a reasonable time, millions of barrels of oil would remain in the formation. This concern was based on the results of the following gas/oil ratio surveys conducted by state conservation authorities and petroleum engineers:

Date	Gas/Oil Ratio
Dec. 1944	1000 cu.ft./bbl.
Nov. 1945	2191 cu.ft./bbl.
Aug. 1946	4971 cu.ft./bbl.
Feb. 1947	5634 cu.ft./bbl.

At the same time bottom-hole pressure surveys showed an alarming decline from 2848 pounds per square inch in 1943, to 1707 pounds per square inch by March, 1947 (Figure 2).

Progressive increases in gas/oil ratios forced operators in many instances to vent the gas produced with the oil into the air and at one time venting reached an estimated 250 million cubic feet daily. Some of the wells in the Kingfisher and Logan County sectors of the pool have never been connected to a gas line due to lack of market for the natural fuel. Public criticism compelled the Oklahoma Corporation Commission to take steps to conserve West Edmond gas and resulted in the issuance of an order reducing the gas/oil ratio limit to 4000 cubic feet per barrel which had the effect of reducing total gas produced with the oil to approximately 175 million feet daily. The gasoline plants which were taking the gas still had insufficient capacity but most of the waste has been eliminated. Under the new program the venting of gas into the air will be halted within a short time. It will require some time after the unitization plan becomes operative to change gas lines and make necessary mechanical changes in the field. Purchasers of natural gas for outside sale will have uninterrupted deliveries of gas until after the winter peak. Following that, the sale to transmission lines may be curtailed.

Confronted with the fact that unless unitization was effected the economic life of the West Edmond pool would be jeopardized, the Operators Committee

called for a hearing which went through 19 days of testimony and two days of arguments by attorneys. Testimony was brought out to show that the West Edmond lime pool was a volumetric reservoir and that increased oil recovery, maintenance of bottom-hole pressure and control of gas/oil ratios could be brought about only by selective production of wells and pressure maintenance through unitization.

In order to protect correlative rights an engineering subcommittee worked out a participation formula (approved by a majority of operators) providing percentage participation of each tract based one-half on its daily allowable divided by the entire daily pool allowable and one-half on effective pay thickness times bottom-hole pressure divided by the sum of all thickness values times pool bottom-hole pressure. Well allowable was calculated as of January, 1947; field allowable at 42,306 barrels per day and bottom-hole pressure as reported in September, 1946.

Sohio Petroleum Company was named operator of the unit, which includes 29,640 acres, 737 wells and 4 undrilled tracts. The company has established a special unit production district under a unit manager (Harold N. Pardee) to operate the field under direction of the Operators Committee in accordance with the unit plan. Earl D. Wallace, vice president of Sohio, has been elected chairman of the Operators Committee.

At the organization meeting in August the Operators Committee also decided to take over active management and operation of the unit on October 1, 1947, and to proceed with all other matters required by the plan to produce the field according to the dictates of sound conservation and effective engineering principles.

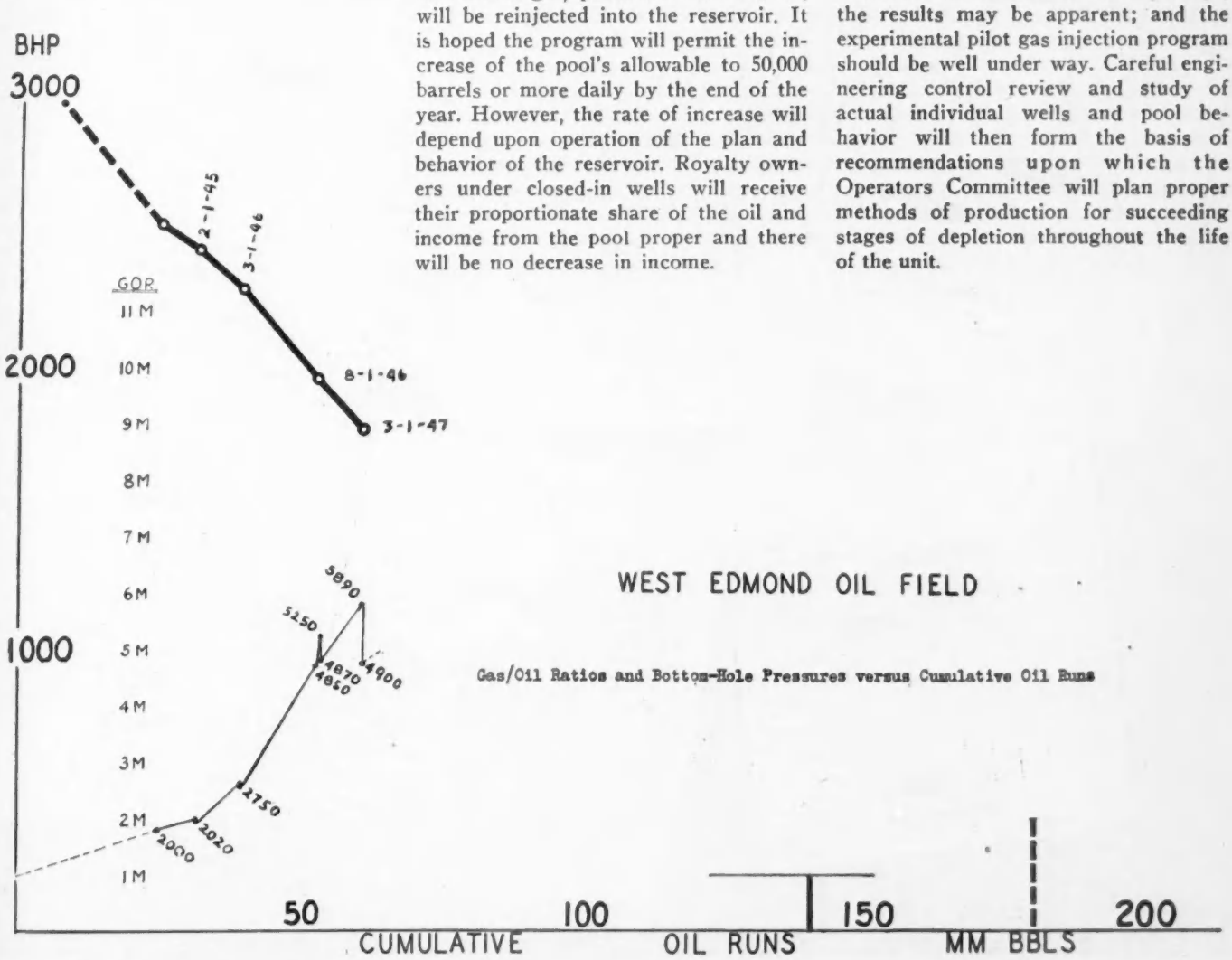
'First step in the unit operation of the pool will be to shut in the wells with high gas/oil ratios and to produce the allowed amount of oil from other wells. The present allowable of approximately 39,000 barrels daily is expected to be held at least through the first two months of operation. High gas/oil areas have been created in several parts of the field and it is estimated some 200 wells will be closed early in October. Bottom-hole pressure surveys will be made at intervals to determine the effect of pressure maintenance caused by the shutin wells. After the selective program has been instituted, pilot tests will be made throughout the pool for gas injection. After the pilot tests have been made, he natural gas, produced with the oil, will be reinjected into the reservoir. It is hoped the program will permit the increase of the pool's allowable to 50,000 barrels or more daily by the end of the year. However, the rate of increase will depend upon operation of the plan and behavior of the reservoir. Royalty owners under closed-in wells will receive their proportionate share of the oil and income from the pool proper and there will be no decrease in income.

Natural gas produced in the pool under the unit operation will be gathered and handled through two large plants already established. The Peppers Refining Company plant in the field has been purchased by Sohio, Phillips Petroleum Company and Stanolind Oil & Gas Company, and other members of the unit will be permitted to purchase an interest at the same price and become common partners in the operation.

Under the unitization plan the West Edmond Hunton lime pool will be operated as a single lease. Property lines vanish, wells will lose their names and numbers, operators' holdings merge into a common holding with single management. Royalty-owners and employes will receive their checks through a single source, and no longer will the switcher or pumper confine his labors to a given small area as "engineered production" goes into play.

In effect, unitization means that the West Edmond pool will be produced at the lowest gas/oil ratio feasible just as soon as the necessary legal, plant, engineering, accounting, and organizational work can be accomplished and resulting necessary changes made in field oil and gas gathering systems, natural gasoline plants and other production facilities.

Within six to nine months perhaps, the results may be apparent; and the experimental pilot gas injection program should be well under way. Careful engineering control review and study of actual individual wells and pool behavior will then form the basis of recommendations upon which the Operators Committee will plan proper methods of production for succeeding stages of depletion throughout the life of the unit.



WEST EDMOND OIL FIELD

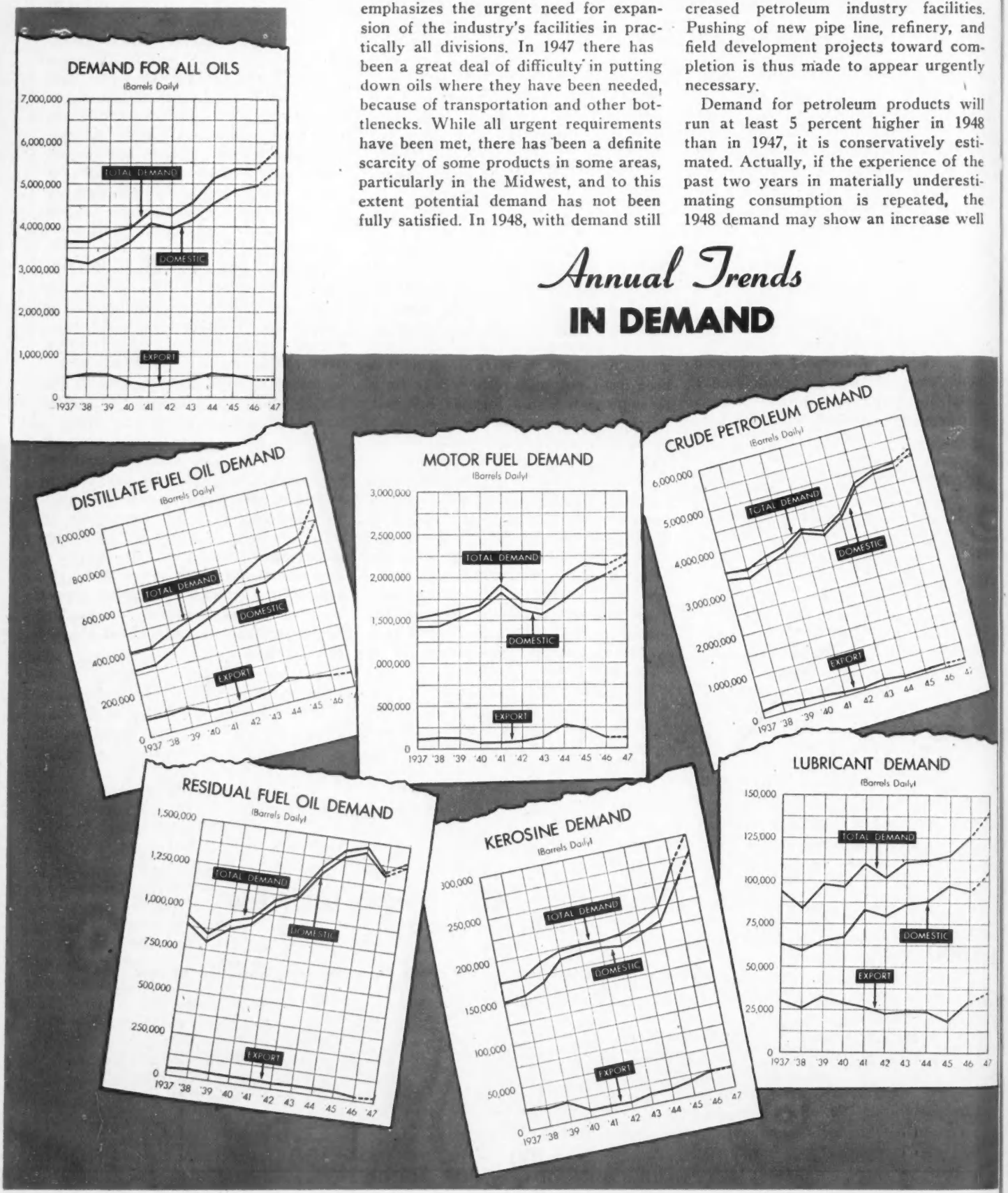
Gas/Oil Ratios and Bottom-Hole Pressures versus Cumulative Oil Runs

Further Difficulty in Meeting Demand

PROSPECT of a new all-time record demand for petroleum products in 1948 emphasizes the urgent need for expansion of the industry's facilities in practically all divisions. In 1947 there has been a great deal of difficulty in putting down oils where they have been needed, because of transportation and other bottlenecks. While all urgent requirements have been met, there has been a definite scarcity of some products in some areas, particularly in the Midwest, and to this extent potential demand has not been fully satisfied. In 1948, with demand still greater, requirements of consumers can be fulfilled only by the utilization of increased petroleum industry facilities. Pushing of new pipe line, refinery, and field development projects toward completion is thus made to appear urgently necessary.

Demand for petroleum products will run at least 5 percent higher in 1948 than in 1947, it is conservatively estimated. Actually, if the experience of the past two years in materially underestimating consumption is repeated, the 1948 demand may show an increase well

Annual Trends IN DEMAND



Is Forecast

above 5 percent and more in line with that of approximately 9 percent now indicated for 1947 as compared with the previous year.

The domestic and predominant part of demand is expected to run in 1948 6 percent or more about 1947, but a possible 10 percent decrease in exports would bring the gain in total demand down to around 5 percent. However, the future trend of exports is quite conjectural and this projected decrease is not at all certain. An aid-to-Europe plan or other developments could change the outlook for exports to an increase instead of a decrease.

Latest publicized preview of oil consumption in 1948 is embodied in the September monthly forecast of the Bureau of Mines, along with a further revision of that agency's forecasts for the full year 1947. The new forecast does not look beyond the first quarter of 1948. But there is special significance in the expected gains of 5 percent for total demand and 6 percent for domestic demand as compared with the first quarter of 1947, on daily average basis. For these increases are projected in spite of the fact that demand was exceptionally heavy —far beyond all expectations—in the first quarter of 1947, having been relatively more brisk in that period than in any other part of this year.

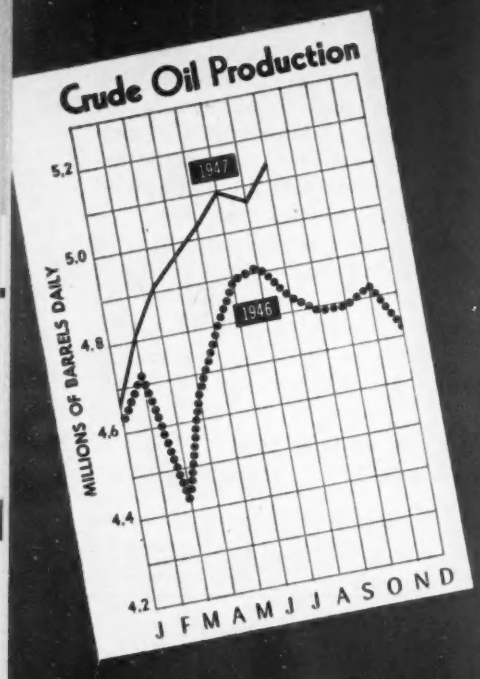
Revised Forecast, United States Supply and Demand, All Oils, 1947 by Quarters and First Quarter 1948

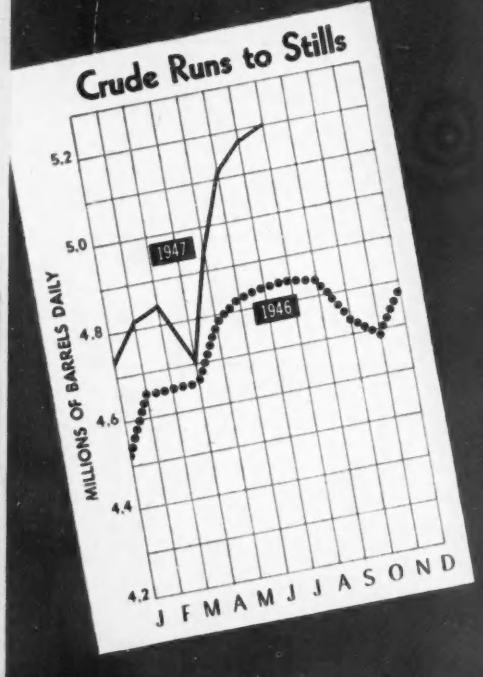
Source: U. S. Bureau of Mines Monthly Petroleum Forecast, September, 1947

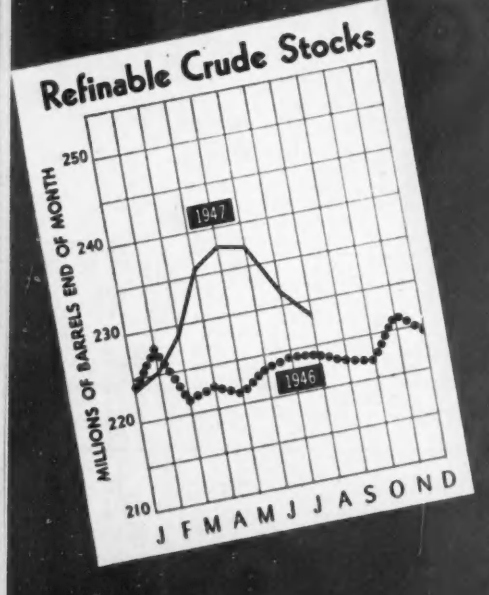
(THOUSANDS OF BARRELS)

ITEM	First Quarter (Actual)	Second Quarter (Actual)	Third Quarter (Estimated)	Fourth Quarter (Forecast)	1947 Year	1946 Year	Percent Diff. 1946–1947	First Quarter 1948	Percent Diff. 1st Quarter 1947–1948
PRODUCTION									
All Oils	463,300	489,900	507,500	508,900	1,969,600	1,850,700	+ 6.4	504,200	+ 8.8
(Daily Average)	5,148	5,384	5,516	5,532	5,396	5,070	+ 6.4	5,541	+ 7.6
Crude Oil	431,700	458,200	474,700	475,000	1,839,600	1,733,400	+ 6.1	470,500	+ 9.0
(Daily Average)	4,797	5,035	5,160	5,163	5,040	4,749	+ 6.1	5,170	+ 7.8
Other Oils	31,600	31,700	32,800	33,900	130,000	117,300	+10.8	33,700	+ 6.6
(Daily Average)	351	349	356	369	356	321	+10.8	371	+ 5.7
IMPORTS									
All Oils	43,400	38,900	41,000	42,000	165,300	135,000	+22.4	42,000	— 3.2
(Daily Average)	482	427	446	457	453	370	+22.4	462	— 4.1
Crude Oil	25,500	23,600	26,000	26,000	101,100	86,100	+17.4	26,000	+ 2.0
(Daily Average)	283	259	283	283	277	236	+17.4	286	+ 1.1
Other Oils	17,900	15,300	15,000	16,000	64,200	48,900	+31.3	16,000	—10.6
(Daily Average)	199	168	163	174	176	134	+31.3	176	—11.6
NEW SUPPLY									
All Oils	506,700	528,800	548,500	550,900	2,134,900	1,985,700	+ 7.5	546,200	+ 7.8
(Daily Average)	5,630	5,811	5,962	5,988	5,849	5,440	+ 7.5	6,002	+ 6.6
STOCKS CHANGE									
All Oils	—25,800	+15,400	+24,900	+2,400	+16,900	+43,500	....	—19,800	....
(Daily Average)	—287	+169	+271	+26	+46	+119	....	—218	....
Crude Oil	+4,800	+7,400	—3,000	+100	+9,600	+6,900	....	+2,200	....
(Daily Average)	+53	+81	—32	+1	+26	+19	....	+24	....
Other Oils	—30,600	+8,000	+27,900	+2,300	+7,300	+36,600	....	—22,000	....
(Daily Average)	—340	+88	+303	+25	+20	+100	....	—242	....
DEMAND									
All Oils, Total Demand	532,500	513,400	523,600	548,500	2,118,000	1,942,200	+ 9.1	566,000	+ 6.3
(Daily Average)	5,917	5,642	5,691	5,962	5,803	5,321	+ 9.1	6,220	+ 5.1
Domestic Demand	494,600	469,600	482,500	512,100	1,958,800	1,791,000	+ 9.4	531,300	+ 7.4
(Daily Average)	5,496	5,161	5,245	5,566	5,367	4,907	+ 9.4	5,839	+ 6.2
Exports	37,900	43,800	41,100	36,400	159,200	151,200	+ 5.3	34,700	— 8.4
(Daily Average)	421	481	447	396	436	414	+ 5.3	381	— 9.5
Crude Oil	8,700	12,400	13,000	11,000	45,100	40,700	+10.8	10,000	+14.9
(Daily Average)	97	136	141	120	123	111	+10.8	110	+13.4
Refined Oils	29,200	31,400	28,100	25,400	114,100	110,500	+ 3.3	24,700	—15.4
(Daily Average)	324	345	306	276	313	303	+ 3.3	271	—16.4
Motor Fuel, Total Demand	180,400	217,500	228,000	208,000	833,900	780,200	+ 6.9	191,000	+ 5.9
(Daily Average)	2,004	2,390	2,478	2,261	2,285	2,138	+ 6.9	2,099	+ 4.7
Domestic Demand	167,600	205,600	217,000	198,000	788,200	734,800	+ 7.3	182,000	+ 8.6
(Daily Average)	1,862	2,259	2,359	2,152	2,160	2,013	+ 7.3	2,000	+ 7.4
Exports	12,800	11,900	11,000	10,000	45,700	45,400	+ 0.7	9,000	—29.7
(Daily Average)	142	131	119	109	125	125	+ 0.7	99	—30.3
Residual Fuel, Total Demand	140,200	123,400	121,000	133,000	517,600	486,600	+ 6.4	140,000	— 0.1
(Daily Average)	1,558	1,356	1,315	1,446	1,418	1,333	+ 6.4	1,538	— 1.3
Domestic Demand	137,500	120,400	118,400	130,500	506,800	477,100	+ 6.2	137,500	....
(Daily Average)	1,528	1,323	1,287	1,419	1,388	1,307	+ 6.2	1,511	— 1.1
Exports	2,700	3,000	2,600	2,500	10,800	9,500	+13.7	2,500	— 7.4
(Daily Average)	30	33	28	27	30	26	+13.7	27	—10.0
Distillate Fuel, Total Demand	101,700	65,500	60,000	89,000	316,200	272,300	+16.1	114,000	+12.1
(Daily Average)	1,130	720	652	967	866	746	+16.1	1,253	+10.9
Domestic Demand	96,300	57,500	54,000	84,000	291,800	243,000	+20.1	109,000	+13.2
(Daily Average)	1,070	632	587	913	799	666	+20.1	1,198	+12.0
Exports	5,400	8,000	6,000	5,000	24,400	29,300	—16.7	5,000	— 7.4
(Daily Average)	60	88	65	654	67	80	—16.7	55	— 8.3
Kerosine, Total Demand	35,400	22,000	20,000	33,000	110,400	97,700	+13.0	39,000	+10.2
(Daily Average)	393	242	217	359	302	268	+13.0	429	+ 9.2
Domestic Demand	32,900	20,100	18,000	31,000	102,000	89,200	+14.3	36,800	+11.9
(Daily Average)	365	221	195	337	279	245	+14.3	405	+11.0
Exports	2,500	1,900	2,000	2,000	8,400	8,500	— 1.2	2,200	—12.0
(Daily Average)	28	21	22	22	23	23	— 1.2	24	—14.3
All Other Oils, Total Demand	74,800	85,000	94,600	85,500	339,900	305,400	+11.3	82,000	+ 9.6
(Daily Average)	831	934	1,028	929	931	837	+11.3	901	+ 8.4
Domestic Demand	60,300	66,000	75,100	68,600	270,000	246,900	+ 9.4	66,000	+ 9.5
(Daily Average)	670	725	816	745	740	677	+ 9.4	725	+ 8.2
Exports	14,500	19,000	19,500	16,900	69,900	58,500	+19.5	16,000	+10.3
(Daily Average)	161	209	212	184	191	160	+19.5	176	+ 9.3
CRUDE NEEDED									
Runs to Stills	432,000	448,175	477,020	475,640	1,832,665	1,730,100	+ 5.9	470,470	+ 8.9
(Daily Average)	4,800	4,925	5,185	5,170	5,021	4,740	+ 5.9	5,170	+ 7.7
Demand for Domestic Crude	428,130	449,540	477,664	474,904	1,830,475	1,727,545	+ 6.0	468,286	+ 9.4
(Daily Average)	4,757	4,940	5,192	5,162	5,015	4,733	+ 6.0	5,146	+ 8.2

Production and Refining







BOTH production and processing of crude were carried on at record levels in August, when producers' output reached a daily average of 5,141,000 barrels and refiners' runs to stills amounted to 5,209,000 barrels per day.

Each was a new all-time high and marked the fourth month that operations extended into the 5 million-barrels a day bracket. In the case of crude production these four months have been consecutive, while only three have been in line for runs to stills, the first having occurred in July, 1945, at the height of the Pacific war.

These stepped-up refinery operations resulted in output of the principal refined products being large and fairly well in line with exceptionally heavy requirements. Stocks of light and heavy fuel oils continued their seasonal build-ups and ended the month slightly ahead of inventories of a year before. Demand for gasoline during the month continued very heavy and despite increased production, stocks slid below last year's figure. These stocks reductions probably would have been even greater had not shortages, arising from inadequate transportation, been present in some areas. Although stocks of refinable crude were reduced during the month, they were still higher at the end of August than they had been at the same time of either of the two previous years.

Daily Crude production in August averaged 5,141,000 barrels, an increase of 76,000 barrels over July's daily output. This all-time peak was 305,000 and 271,000 barrels, respectively, over the daily averages of August, 1946 and 1945. The previous record-high production was 5,099,000 barrels in June, of this year.

An increase in Texas' production accounted for 57,000 barrels daily of the total 76,000-barrel gain over July. Several other states showed smaller increases to complete the total. Some of the gaining areas with their increases: Louisiana, 7800 barrels daily; Oklahoma, 3700; Kansas, 3600; California, 3400;

Crude Oil and Refined Products Trends

(THOUSANDS OF BARRELS)

MONTH	CRUDE OIL			GASOLINE		GAS-OIL AND DISTILLATE FUEL		RESIDUAL FUEL	
	Production Daily	Runs to Stills Daily	Stocks End of Month	Production Daily	Stocks End of Month	Production Daily	Stocks End of Month	Production Daily	Stocks End of Month
1945:									
January	4,756	4,680	221,737	2,094	91,666	663	31,695	1,350	44,347
February	4,767	4,817	220,221	2,194	97,457	724	27,210	1,326	39,760
March	4,804	4,719	223,988	2,124	97,447	675	26,729	1,273	35,451
April	4,807	4,774	224,229	2,127	90,804	681	29,148	1,289	34,418
May	4,877	4,913	223,151	2,179	88,330	708	29,511	1,341	34,333
June	4,859	4,989	218,218	2,166	88,128	730	32,440	1,351	35,606
July	4,897	5,001	216,038	2,281	85,582	713	36,276	1,351	38,341
August	4,870	4,928	215,135	2,269	84,003	701	41,245	1,329	42,227
September	4,423	4,275	220,319	1,933	74,574	640	45,059	1,139	42,822
October	4,284	4,244	221,246	1,888	76,805	613	45,479	1,176	42,068
November	4,517	4,624	218,916	2,156	86,540	665	44,562	1,265	41,322
December	4,472	4,574	218,763	2,056	97,676	693	35,778	1,245	37,158
1946:									
January	4,625	4,520	223,442	1,914	102,394	787	28,990	1,224	34,573
February	4,719	4,651	227,220	1,884	104,836	823	25,511	1,243	34,008
March	4,414	4,661	221,400	1,900	104,161	816	29,922	1,213	32,995
April	4,673	4,663	222,480	1,943	98,744	773	32,064	1,247	35,206
May	4,785	4,794	221,592	2,016	93,960	753	33,885	1,220	38,932
June	4,896	4,836	223,140	2,055	91,971	777	38,824	1,219	41,492
July	4,922	4,856	224,351	2,102	87,778	793	46,439	1,163	45,446
August	4,836	4,856	224,157	2,189	86,745	765	54,068	1,159	48,186
September	4,790	4,839	222,417	2,143	87,021	796	62,019	1,150	54,012
October	4,785	4,736	222,177	2,117	85,952	788	76,870	1,090	55,580
November	4,823	4,684	226,453	2,162	88,587	791	68,145	1,101	52,735
December	4,725	4,780	224,473	2,168	92,742	805	59,912	1,159	47,094
1947:									
January	4,671	4,739	223,848	2,078	99,623	778	48,197	1,174	41,550
February	4,810	4,820	225,121	2,089	103,672	777	36,901	1,228	38,489
March	4,908	4,843	228,981	2,076	105,679	825	31,423	1,222	37,403
April	4,974	4,707	235,710	2,037	101,724	764	30,268	1,148	36,455
May	5,033	4,947	237,768	2,128	95,209	805	34,279	1,204	39,992
June	5,099	5,120	237,278	2,258	89,774	807	39,676	1,233	43,515
July	5,065	5,178	231,437	2,295	85,693	814	47,977	1,244	44,942
August	5,141	5,209	228,281	2,340	83,995	852	55,087	1,255	50,022
August, 1947 Changes:									
In Month	+76	+31	−3,156	+45	−1,698	+38	+7,110	+11	+5,080
In 1 Year	+305	+353	+4,124	+151	−2,750	+87	+1,019	+96	+1,836
In 2 Years	+271	+281	+13,146	+71	−8	+151	+13,842	−74	+7,795

At New Highs In August

Wyoming, 3300; and Mississippi, 3200.

The month's runs to refinery stills averaged 5,209,000 barrels daily, for a new record, and an increase of 31,000 barrels over the previous month's daily charges to stills. In comparison with previous years, August's runs represented an increase of 353,000 barrels a day over those of the like period of 1946 and 281,000 over same period of the year before that. About 92 percent of the nation's total refining capacity was utilized in August's refining operations.

At the end of August stocks of refinable crude totaled 228,281,000 barrels, showing a drop of 3,156,000 barrels since the beginning of the month. That amount was 4,124,000 barrels more than was on hand a year earlier and 13,146,000 barrels more than was in storage two years before. However, gasoline bearing crude stocks were still about 21 million barrels less than was on hand at this point of the last prewar year.

Gasoline production in the month amounted to 2,340,000 barrels a day, an increase of 45,000 daily over output in the previous month, and 151,000 barrels over the like period of 1946 and 71,000 a day more than was produced in August of wartime 1945. Demand for gasoline in all areas remained very high as motoring and agricultural needs were at a peak. Distribution of gasoline stocks presented considerable problem and some areas, particularly the Middle West, experienced scarcity of this material. These shortages were the results of insufficient transportation facilities, and refiners in the area necessarily supplied users from daily make, thereby adding little or none to their inventories. Stocks of finished and unfinished gasoline totaled 83,995,000 barrels at the end of August, a drop of 1,698,000 barrels from the previous month's total. That amount was 2,750,000 barrels less than was on hand a year earlier and 8000 barrels less than at end of August, 1945.

Production of distillate fuels averaged 852,000 barrels a day during the month, an increase of 38,000 barrels daily over July's output, 87,000 barrels more than a year ago, and 151,000 barrels more two years before. Stocks at the end of the month totaled 55,087,000 barrels after increasing 7,110,000 barrels. That amount was 1,019,000 barrels more than was on hand a year before and 13,842,000 barrels more than two years ago.

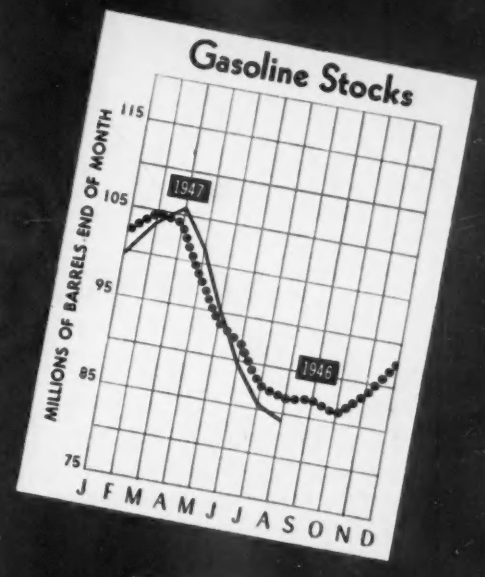
Residual fuel output was hiked 11,000 barrels daily to average 1,255,000 a day. That was 96,000 barrels a day over production a year ago, but 74,000 a day less than two years before. Stocks of these heavy fuels climbed 5,080,000 barrels to 50,022,000 barrels. That was 1,836,000 barrels over 1946 and 7,795,000 barrels over inventory at last of August, 1945.

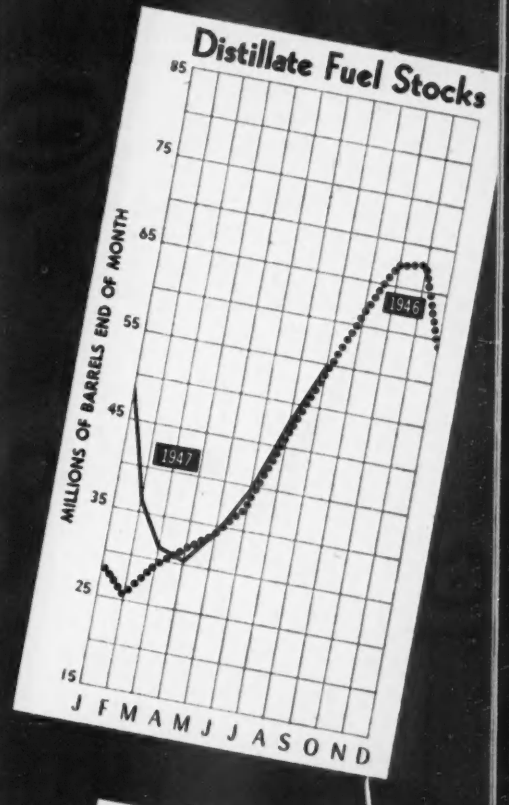
In order to process the great amounts of crude during August about 92 percent of the nation's refining capacity was required. That was a high rate of operation and to maintain that level is difficult, due to necessary time out for cleaning and repairing equipment and other delays. Some areas operated their refineries over rated capacity, while others operated somewhat less than the national average.

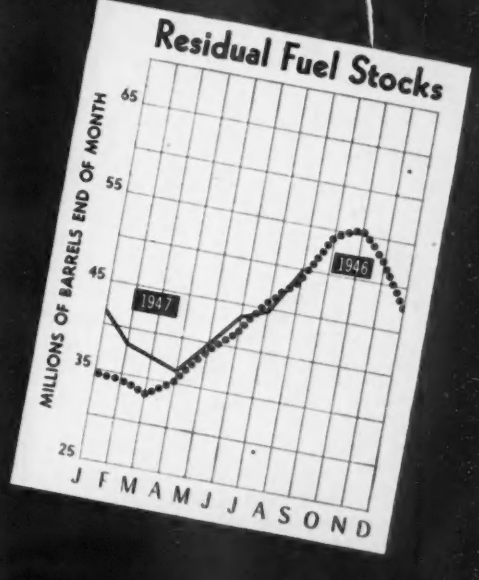
The East Coast plants and those of Coastal Louisiana operated at over 100 percent of their rated daily capacity.

State Crude Oil Production
(THOUSANDS OF BARRELS)

STATE OR DISTRICT	DAILY AVERAGE IN AUGUST 1947	1946	1945	July, 1947
Alabama	1.1	1.1	0.7	1.1
Arkansas	76.1	77.7	77.3	75.5
California	923.4	867.2	919.9	920.0
Colorado	48.4	38.3	12.0	45.6
Florida	1.0	0.1	0.1	1.0
Illinois	173.5	201.2	208.1	181.1
Indiana	17.0	18.3	14.3	17.7
Kansas	295.7	279.1	265.6	292.1
Kentucky	25.1	29.2	28.6	26.1
Louisiana	429.5	400.2	361.9	421.7
North Louisiana	99.6	87.7	63.5	97.1
South Louisiana	329.9	312.5	298.4	324.6
Michigan	43.2	48.3	47.7	43.3
Mississippi	99.5	71.6	53.9	96.3
Missouri	0.1	0.2	0.1	0.1
Montana	23.9	24.5	23.6	23.2
Nebraska	0.5	0.8	0.8	0.6
New Mexico	108.7	102.4	103.4	108.4
New York	13.1	13.4	13.9	13.8
Ohio	9.0	7.8	8.5	8.8
Oklahoma	390.0	374.1	389.0	386.9
Pennsylvania	33.5	36.5	35.9	34.0
Tennessee			0.1	
Texas	2,299.0	2,128.9	2,193.2	2,242.0
Dist. 1—South Central	23.5	19.5	21.4	22.3
Dist. 2—Middle Gulf	159.3	153.7	153.9	155.0
Dist. 3—Upper Gulf	487.1	484.0	508.4	483.5
Dist. 4—Lwr Gulf-S.W.	241.4	227.3	223.3	230.9
Dist. 5—East Central	39.5	41.7	42.4	39.2
Dist. 6—Northeast	439.5	423.1	476.1	438.1
Dist. 7-B—No. Central	39.3	33.0	31.6	37.3
Dist. 7-C—W. Central	39.5	27.9	24.7	39.0
Dist. 8—West	619.4	493.6	495.9	586.4
Dist. 9—North	216.9	125.8	123.3	126.1
Dist. 10—Panhandle	83.6	82.3	86.1	84.2
Virginia	0.1			0.2
West Virginia	7.2	8.9	8.5	7.3
Wyoming	121.6	106.0	102.7	118.3
Total United States	5,140.8	4,835.8	4,869.8	5,065.







Completions DROP BUT TOP YEAR'S AVERAGE

TOTAL well completions during August were less than those in July, but the month still was considerably above the average for the year. Drilling during July had resulted in an unusually large number of completions and the drop in August did not indicate an easing in drilling operations. Throughout the month there was a steady increase of active drilling rigs and while they did not boost the period's completion record, the results will show in succeeding periods since many of these rigs were put into operation in comparatively deep areas.

August completions numbered 3077, a decline from July's 3287, but a sizeable increase from the 2720 wells completed in August of last year. Of August's total wells, 487 were exploratory completions, while 524 were of this category in the previous month. Although August failed to match July's peak in either total or exploratory well completions, it holds second place for each so far this year.

At the end of eight months U. S. completions totaled 21,328, for an increase of 1131 wells or 5.6 percent over last year's like period. With active rigs at a new all-time high of 5196 at the end of August the margin of difference between the two years should become considerably greater by the end of December.

Several of the more active drilling states' current and last year's records are compared. Texas has completed 6170 wells so far this year against 5751 last year and at the end of August had 1393 rigs working against 1041 a year before. Oklahoma completed 2439 against 1954 last year and had 527 rigs active against 433. Kansas' completions were upped to 1620 from 1442 and rigs increased to 387 from 301 last year. New Mexico's wells increased to 389 from 297 and its rigs to 134 from 93. Mississippi's completions were boosted to 303 from 148 and rigs were increased to 78 from 51.

Well Completions in the United States During August, 1947, and Cumulative for Year

(Figures compiled by World Oil staff from private reports and other sources as follows: Illinois from Illinois Geological Survey; Indiana from Indiana Division of Geology; Missouri from Missouri Geological Survey; Tennessee from Tennessee Division of Geology; Bradford, Kane-Clarendon, and Allegany fields of Pennsylvania and New York from Producers' Monthly)

STATE OR DISTRICT	MONTHLY COMPLETIONS, AUGUST, 1947									Total Completions				CUMULATIVE TOTAL January-August				Rigs in Operation (Drilling, Rigging Up and Shut Down)		
	New Wells								Total Drilled Deeper											
	Oil	Dist.	Gas	Dry	Water Input	Gas Input	Water Disposal	Total New		Aug., 1947	July 1947	Aug., 1946	Footage August, 1947	Wells 1947	Wells 1946	Percent Diff.	Footage, 1947	Aug., 31, 1947	July 31, 1947	Aug. 31, 1946
Alabama				2				2	..	2	3	2	6,200	14	10	+ 40.0	53,603	6	8	6
Arizona									..						1	—100.0			2	
Arkansas	23			19				42	..	42	26	19	164,363	188	126	+ 49.2	795,216	42	31	31
California	118		6	27				151	2	153	143	149	647,176	1,230	1,276	— 3.6	5,183,074	277	254	268
Colorado	13		2	2				17	1	18	25	17	97,218	122	98	+ 24.5	662,995	81	74	64
Florida				3				3	..	3	2	2	19,027	22	17	+ 29.4	114,750	6	6	6
Georgia									..		2			3	2	+ 50.0	11,945	1	1	
Illinois	95			111				206	2	208	188	188	523,929	1,298	1,460	— 11.1	3,297,268	250	235	279
Indiana	13		2	31				46	3	49	58	57	82,623	362	327	+ 10.7	658,083	82	87	78
Iowa									..											1
Kansas	113		26	73				212	13	225	274	197	703,899	1,620	1,442	+ 12.3	5,076,804	387	378	301
Kentucky	29		27	26				82	..	82	93	82	141,027	570	580	— 1.7	1,037,072	116	119	106
Louisiana	104	6	8	53			2	173	..	173	184	127	895,700	980	903	+ 8.5	5,504,133	188	196	146
North Louisiana	64	4	8	30			1	107	..	107	128	79	305,372	561	511	+ 9.8	1,756,477	71	61	50
South Louisiana	40	2		23			1	66	..	66	56	48	590,328	419	392	+ 6.9	3,747,656	117	135	96
Michigan	36		8	37				81	..	81	66	81	178,962	425	532	— 20.1	977,755	121	134	101
Mississippi	20		5	13				38	1	39	51	15	326,557	303	148	+104.8	2,561,390	78	85	51
Missouri									..		2	3		28	22	+ 27.3	13,109	6	5	3
Montana	14		2	7				23	..	23	34	31	58,091	130	183	— 29.0	316,867	78	72	60
Nebraska									..		1	3		1	3	— 66.7	6,788	5	6	7
New Mexico	24		3	12				39	3	42	59	44	167,739	389	297	+ 31.0	1,598,259	134	135	93
New York	121			1	76			198	..	[5]198	[5]187	111	276,687	[5]1,181	784	[5]+ 50.6	1,671,575	[5]240	[5]231	136
North Carolina									..					1	1		6,370			
Ohio	33		48	39				120	4	124	128	120	341,688	881	818	+ 7.7	2,520,255	252	239	255
Oklahoma	164	[1]	10	103		2		280	16	296	352	337	894,854	2,439	1,954	+ 24.8	7,293,824	527	515	423
Oregon									..					1	2	— 50.0	8,500			
Pennsylvania	128		56	25	112	24		345	6	351	283	249	610,158	2,242	2,831	— 20.8	3,884,912	431	416	433
South Dakota									..											5
Tennessee				2				2	..	2	2		6,550	13	7	+ 85.7	18,446	11	7	5
Texas	488	20	38	285				831	15	846	1,014	789	3,440,989	6,170	5,751	+ 7.3	26,179,482	1,393	1,284	1,041
Dist. 1—S. Central	11		3	19				33	..	33	31	20	94,125	212	118	+ 79.7	744,203	36	29	25
Dist. 2—Middle Gulf	28	8	1	18				55	1	56	65	[1]	356,007	421	[1]	[1]	2,574,711	62	58	[1]
Dist. 3—Upper Gulf	34	4	3	37				78	1	79	94	60	522,586	548	462	+ 18.6	3,489,223	137	124	70
Dist. 4— L. Gulf-S.W.	34	5	5	33				77	2	79	113	138	409,713	735	1,092	+ 5.9	3,903,835	109	108	118
Dist. 5—E. Central	5		3	7				15	..	15	18	[2]	70,664	96	[2]	[2]	491,809	22	29	[2]
Dist. 6—Northeast	21	3	9	13				46	..	46	56	101	247,313	327	513	— 17.5	1,649,563	68	61	84
Dist. 7-B—N. Central	46		1	40				87	3	90	96	[3]	241,957	574	[3]	[3]	1,743,703	126	122	[3]
Dist. 7-C—W. Central	18			7				25	..	25	27	[4]	91,142	172	[4]	[4]	590,546	73	62	[4]
Dist. 8—West	150			17				167	3	170	197	183	745,308	1,292	1,218	+ 20.2	6,135,881	495	404	408
Dist. 9—North	113		6	86				205	4	209	264	257	500,761	1,470	2,088	— 2.1	3,765,915	136	162	252
Dist. 10—Panhandle	28		7	8				43	1	44	53	30	161,413	323	260	+ 24.2	1,099,093	129	125	84
Utah									..			1		3	3		14,143	6	6	3
Virginia									..			2			2	—100.0				
Washington									..						1	—100.0			1	
West Virginia	11		70	11				92	4	96	83	77	255,679	567	508	+ 11.6	1,541,340	362	368	373
Wyoming	14		1	9				24	..	24	27	17	98,312	145	108	+ 34.3	661,159	116	97	59
Total United States	1,561	27	312	891	188	26	2	3,007	70	3,077	3,287	2,720	9,937,428	21,328	20,197	+ 5.6	71,669,117	5,196	4,992	4,334

[1] Dist. 2 included with Dist. 4. [2] Dist. 5 included with Dist. 6. [3] Dist. 7-B included with Dist. 9. [4] Dist. 7-C included with Dist. 8. [5] Part of Bradford field now included in New York; formerly, all was carried in Pennsylvania.

Exploration 12 PERCENT AHEAD OF LAST YEAR

EXPLORATORY drilling remained at a high level during August and although well completions of this type were slightly under those of July, they were second highest of the year. At the end of eight months exploratory wells were about 12 percent ahead of last year's record, which was the highest in history.

August's exploratory completions numbered 487, just slightly less than the year's peak of 524 completed in the previous month, but an increase over the 434 wells in August of last year. Of the current total wells 93, or 19.1 percent, were rated as producers, while 106 wells or 20.2 percent found production in the previous month. In the like month a year ago only 70 or 16.1 percent was successful.

Results of August's exploration drilling were 51 new crude sources, 29 new fields and 22 new pay horizons in existing fields; 7 new distillate fields and the same number of new distillate pays, and 4 each of new gas fields and new pay formations. Also included were extensions of at least ½ mile to 17 oil fields and 3 gas pools.

Records for the first eight months of this year show 3400 exploratory well completions, an increase of 12.5 percent over the 3023 wells in the same period of 1946. So far 684 of the year's total have been productive for a score of 20.1 percent, while last year's period showed 597 successful, for 19.7 percent.

Oil discoveries for the year thus far number 445 against 331 a year ago.

Summary of Results of Exploratory Drilling

ITEM	Aug., 1947	July, 1947	EIGHT MONTHS: JAN.-AUG. 1947	1946	Percent Dif.
Oil Discoveries	51	67	445	331	34.4
New Fields	29	33	253	196	+ 29.1
New Pays	22	34	192	135	+ 42.2
Distillate Discoveries	14	10	68	44	+ 54.5
New Fields	7	6	32	21	+ 52.4
New Pays	7	4	36	23	+ 56.5
Gas Discoveries	8	11	71	82	+ 13.4
New Fields	4	9	52	63	+ 17.5
New Pays	4	2	19	19	.....
Total Discoveries	73	88	584	457	+ 27.8
Extensions to Fields	20	18	100	140	— 28.6
Oil Fields	17	10	75	105	— 28.6
Distillate Fields	.....	2	9	4	+125.0
Gas Fields	3	6	16	31	+ 48.4
Total Prod. Tests	93	106	684	597	+ 14.6
Dry Holes	394	418	2,716	2,426	+ 12.0
Wildcats	377	408	2,628	2,365	+ 11.1
New Pays	12	7	48	27	+ 77.8
Outposts	5	3	40	34	+ 17.6
Total Expl'tory Tests	487	524	3,400	3,023	+ 12.5
Percent Productive	19.1	20.2	20.1	19.7	.....
Percent Dry	80.9	79.8	79.9	80.3	.....

Results of Exploratory Drilling in August and First 8 Months, 1947-1946, by Districts

State or District	MONTH OF AUGUST, 1947													FIRST EIGHT MONTHS, 1947															
	Productive Tests									Unproductive Tests			Total Exploratory Tests	Productive Tests									Unproductive Tests				Total Exploratory Tests	
	New Fields			New Pays			Extensions			Total Productive					New Fields			New Pays			Extensions			Total Productive			Total Dry			
	Oil	Gas	Dis.	Oil	Gas	Dis.	Oil	Gas	Dis.		Wildcats	New Pays	Outposts		Oil	Gas	Dis.	Oil	Gas	Dis.	Oil	Gas	Dis.	8 Mo. 1947	8 Mo. 1946	Wildcats	New Pays	Outposts	8 Mo. 1947	8 Mo. 1946	8 Mo. 1947	8 Mo. 1946
Alabama											2			2												10			10	7	10	7
Arizona																													1		1
Arkansas											10			10	3			2		1				6	4	41	1		42	32	48	36
California	1			3				1		5	20			25	6	1		8			3	1		19	22	172			172	161	191	183
Colorado		1					1	1		3	3			6	1	1					1	2		5	5	22		6	28	10	33	15
Florida											3			3											1	21			21	16	21	17
Georgia																										3			3	2	3	2
Illinois	2			4			11			17	48			65	22			41			30			93	63	256			256	310	349	373
Indiana	1									1	12			13	7			6			1			14	13	80			80	52	94	65
Kansas	5									5	35			40	36	8					1	1		46	58	220			220	173	266	231
Kentucky											3			3	2			1			1			4	13	37			37	61	41	74
Louisiana	1			2		1				4	26	3		33	13	4	6	17		12	4		1	57	55	174	6		180	134	237	189
N. Louisiana	1									1	19	2		22	6	1	1	2			1		1	12	14	115	5		12	81	132	95
S. Louisiana				2		1				3	7	1		11	7	3	5	15		12	3			45	41	59	1		60	53	105	94
Michigan	1									1	25		1	27	6	3					2			11	21	132	1	2	135	159	146	180
Mississippi											7			7		1		1			3			5	4	55			55	41	60	45
Missouri																										9			9	14	9	14
Montana	1				1					2			1	3	1				1		1			3	2	6	1	1	8	13	11	15
Nebraska																										1			1	3	1	3
New Mexico											7	2		9	3			1			1	1		6	4	38	5		43	37	49	41
New York																														1		1
North Carolina																										1			1	1	1	1
Ohio											3			3		1			5					6	20	32			32	27	38	47
Oklahoma	6	2								8	34			42	54	9	1	2			1			67	81	357			357	181	424	262
Oregon																										1			1	2	1	2
Pennsylvania																									2	3			3	4	3	6
Tennessee											2			2												12			12	2	12	2
Texas	11	1	7	13	3	6	2			43	133	7	3	186	97	20	25	111	18	23	22	5	8	329	215	919	31	24	974	958	1303	1173
Dist. 1 S. Central											10			10	7			1						8	7	80		1	81	871	89	78
Dist. 2 Middle Gulf	1		4			2	1			8	14			22	7	4	12	10	5	7	2	1		48	[1]	76		3	79	[1]	127	[1]
Dist. 3 Upper Gulf	1	1	1	2	1	1				7	19	3		29	12	4	8	14	5	7	4		3	57	47	106	3	2	111	93	168	140
Dist. 4 L. Gulf-S.W.	3		1	4	1	2				11	23	1	2	34	17	9	4	30	6	7	1	2	4	80	47	149	2	8	159	209	239	256
Dist. 5 E. Central											6			6				2			2	1		5	[2]	40	2	1	43	[2]	48	[2]
Dist. 6 Northeast			1			1				2	5	1	1	9	2	1	1	1		2			1	8	20	32	3	2	37	66	45	86
Dist. 7-B N. Cent.	4			3						7	18	2		27	22			20			1			43	[3]	152	7	1	160	[3]	203	[3]
Dist. 7-C W. Cent.	1			1			1			3	5			8	8			1			3			12	[4]	22	2	1	25	[4]	37	[4]
Dist. 8 West				1	1					2	8			10	7			12	2		4			25	33	76	5	5	86	119	111	152
Dist. 9 North	1			2						3	24			27	14	2		2			5			41	61	173	5		178	388	219	449
Dist. 10 Panhandle											4			4	1							1		2		13	2		15	12	17	12
Utah																									1	3			3	2	3	3
Virginia																														2		2
Washington																														1		1
West Virginia											2			2		3								3	3	6			6	7	9	10
Wyoming							3	1		4	2			6	2	1		2			4	1		10	10	17	3	7	27	12	37	22
Total U.S.	29	4	7	22	4	7	17	3		93	377	12	5	487	253	52	32	192	19	36	75	16	9	684	597	2628	48	40	2716	2426	3400	3023

[1] Dist. 2 included with Dist. 4. [2] Dist. 5 included with Dist. 6. [3] Dist. 7-B included with Dist. 9. [4] Dist. 7-C included with Dist. 8.

WIGGINS HIDEK FLOATING ROOF

WIGGINS BALLOON ROOF

WIGGINS BREATHER ROOF

WIGGINS DRY SEAL LIFTER ROOF

WIGGINS DRY SEAL GAS HOLDER

WHY A WIGGINS HIDEK FLOATING ROOF?

REDUCTION OF LOSSES

Example:

Tank Capacity ..... 80,000 bbls.
Stored Liquid ..... 9 pound Reid gasoline
Pumping ..... 960,000 bbls. per year

	Roof Tank Cone	Wiggins Floating Roof
Standing loss per year	1,600 bbls.	120 bbls.
Pumping loss	1,536 bbls.	0 bbls.
Total annual evaporation loss ..	3,136 bbls.	120 bbls.
Net annual savings		3,016 bbls.

QUICK PAYOFF

Saving 3,016 bbls. in the example above would more than pay for the extra cost of the Hidek Roof in one year.

RETENTION OF GASOLINE QUALITY

The extremely small vapor loss assures the retention of the original volatility specifications.

LOW MAINTENANCE

All parts of this relatively simple structure are readily accessible. Normal periodic inspection is the only maintenance requirement.

ELIMINATION OF EXPLOSION HAZARD

Vapor losses from a Wiggins Hidek Roof are so low that they can never reach the critical explosive concentration.

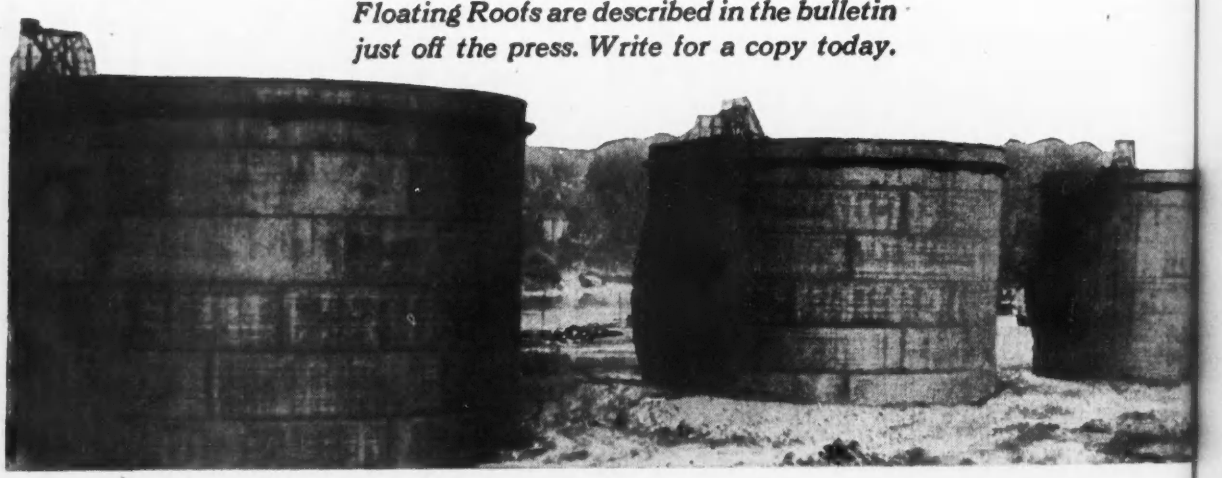
ELIMINATION OF FIRE HAZARD

With vapors hermetically sealed, insulation is so complete that tanks equipped with Wiggins Floating Roofs have survived intense fires in adjacent tanks without damage.

CORROSION RESISTANCE

Corrosion in sour crude oil storage tanks is accelerated by the presence of moisture-laden air. By eliminating such accumulation, Wiggins Hidek Roofs greatly inhibit this corrosive action.

Many other advantages of Wiggins Hidek Floating Roofs are described in the bulletin just off the press. Write for a copy today.



General American
TRANSPORTATION CORPORATION

135 SOUTH LA SALLE STREET, CHICAGO 90, ILLINOIS

BRANCH OFFICES: New York • Washington, D. C. • Cleveland • Buffalo • Pittsburgh
St. Louis • New Orleans • Tulsa • Dallas • Houston • Seattle • Los Angeles • San Francisco

SUB-LICENSEES:

WESTERN STATES: Consolidated Steel Corp. — Western Pipe & Steel Co. of California, Los Angeles — San Francisco
SOUTHERN STATES: Wyatt Metal and Boiler Works, Houston — Dallas, Texas
FRANCE: Etablissements Delattre & Frouard reunis, Paris
CANADA: Toronto Iron Works, Ltd., Toronto

WIGGINS GATX GENERAL AMERICAN VAPOR SEALS

However, there have been fewer extensions to oil fields than last year, the totals being 75 to 105. This year's 68 distillate discoveries are considerably ahead of the 44 recorded for last year's eight-month period. Major extensions to distillate fields stand at nine to last year's four.

New gas finds this year are trailing last year's as 71 have been made, compared with 82 a year ago. To date, gas field extensions total only 16 against 31 a year ago.

Of the 3400 exploratory wells completed this year, 2965 or 87.2 percent was strict wildcats. During last year's comparable period 2645 out of 3023 were of this classification, and amounted to 87.5 percent. The remaining ventures were semi-wildcat, or attempts to find additional pay strata in established fields or to extend the boundaries of existing fields by at least ½ mile. Strict wildcatting this year has been successful in 11.4 percent of the ventures.

New Oil, Distillate and Gas Fields and New Pay Horizons Discovered in the United States in August, 1947

Also Important Extensions to Established Fields

COUNTY	FIELD	COMPANY, WELL AND LOCATION	Date Completed	Total Depth (Feet)	Completion Horizon (Feet)	[1]Name, Character and Age of Producing Formation	[2]Initial Production Method and Choke	Gravity of Oil
		CALIFORNIA—New Oil Field						
Kern	.....	Pacific Western Oil Corp's Midway-McKittrick A-84-30, 30-30s-22e, 2 mi sw of McKittrick.	8- -47	5196	4730- 4785	Point of Rocks sd: Mio	F 600; ¼"	35
		CALIFORNIA—New Oil Pays						
Los Angeles	Del Valle	R. E. Havenstrite's Lincoln 15, 16-4n-17w	8-29-47	12868	10933-11762	.....	F 400; 1/16"	32
Santa Barbara	Four Deer	Sunray Oil Corp's Los Flores 1-A	8- -47	940	.....	.....	P (?)	.....
Santa Barbara	Four Deer	Sunray Oil Corp's Los Flores 2, in new area 1 mi se Orcutt fld.	8- -47	5527	4390- 4510	Chert	F 100	31
		CALIFORNIA—Gas Field Extension						
Butte	Chico	Standard of Calif's Wahl 1, 32-21n-1e, 1½ mi ne extension.	8- -47	2326	2108- 2149	.....	11.6 mln; 7/8"	.....
		COLORADO—Oil Field Extension						
Moffat	Powder Wash.	Sprecher Drlg Co's et al Gov't. 1, sw sw nw 34-12n-97w	8- 1-47	5225	4598- 4626	Wasatch sd; Eoc	P 214; 80 wtr	.....
		COLORADO—New Gas Field						
Ouray	.....	Hackathorn Drlg. Co's Ashing 1, c sw sw 11-45n-8w, Ridgway area	8- -47	410	.....	Dakota sd; U. Cre	.2 mln; open	.....
		COLORADO—Gas Field Extension						
Rio Blanco	Piceance Crk.	General Petroleum's 66-5-G, ne nw se 5-2s-96w, 1 mi extension	7-13-47	3100	.....	Green River sd; Eoc	4 mln.	.....
		ILLINOIS—New Oil Fields						
Clark	Westfield, E.	Van Tarble's Tarble Bros. 3, se ne se 2-11n-14w, 1½ mi e old Westfield pl.	8- 5-47	428	418- 426	Pennsylvanian sd; Penn	P 50	.....
Gallatin	Ab Lake	Sohio's J. Lynch 1, ne ne ne 32-8s-10e, 2 mi s Inman and Inman, E. pls.	8-12-47	2790	2716- 2734	Lwr Renault li; Miss	P 149	.....
		ILLINOIS—New Oil Pays						
Gallatin	Inman	C. C. Clark's Dailey 2, 111 fr nl, 320 fr wl, sw se 19-8s-10e	8-19-47	932	924- 932	Pennsylvanian sd; Penn	P 25	.....
Wabash	Berryville	Phillips Pet. Co's Fite 1, se ne ne 35-2n-14w	8-12-47	3013	2911-	Rosiclare li; Miss	P 150	.....
Wabash	Maud, N	Hayes & Wolfe's L. Peter "A"-1, nw nw nw 20-1s-13w, ½ mi s extension	8-12-47	2939	2859-	Rosiclare li; Miss	P 32	.....
White	Calvin, N	D. Miller Drlg Co's Johnson 1, (OWWO) ne se sw 6-4s-11e, ½ mi sw extension	8-26-47	3204	3048- 3054	Lwr O'Hara li; Miss	P 42; 40 wtr	.....
		ILLINOIS—Oil Field Extensions						
Bond	Woburn, S	L. Horton's L. F. Stoecklin 1, sw se se 16-6n-2w, ½ mi w extension	8-12-47	3179	3158- 3176	"Trenton" li; Ord	P 45	.....
Clinton	Beaver Crk., S	A. M. Fowley & A. Jackson's Burkett 1, sw nw sw 5-3n-2w, 1 mi ne ext.	8-12-47	1150	1147- 1149	Bethel sd; Miss	P 5; 5 wtr	.....
Hamilton	Rural Hill	B. Taylor (Fryer & Simpson) Wilson 1, (OWWO) ne se sw 30-6s-6e, 1½ mi se extension.	8- 5-47	3192	3180- 3190	Aux Vases sd; Miss	P 52; 71 wtr	.....
Marion	Salem	B. Taylor et al's H. J. Sebastian (Schumacher) 1, nw ne sw 21-1n-2e, 1¼ mi s extension.	8-31-47	1935	1920- 1931	Bethel sd; Miss	P 11; 30 wtr	.....
Richland	Noble, N	P. Fulk's T. Diesser 1, 688 fr nl, 330 fr wl, nw nw 36-4n-9e, ½ mi extension	8-12-47	2981	2554- 2567	Cypress sd; Miss	P 18; 2 wtr	.....
Shelby	Shelbyville	P. Doran R. Manning 1, ne nw sw 14-11n-4e, 1¾ mi ne extension	8-31-47	2084	1866- 1880	Aux Vases sd; Miss	P 69; 43 wtr	.....
Wabash	Maud, N	Calvert & Willis' A. Garwood 1, nw nw sw 16-1s-13w, 1 mi e extension	8-26-47	2608	2586- 2608	Bethel sd; Miss	P 34	.....
Wayne	Boyleston Consol.	Robinson & Puckett's Henson Consol 1, 330 fr sl, 600 fr wl, se ne 30-1s-8e, 1½ mi extension.	8-26-47	3453	3320- 3327	McClosky li; Miss	P 30; 60 wtr	.....
Wayne	Clay City Consol.	Tuley & Carter & Aurora Gas's J. O. Sandlin 1, 330 fr sl, 495 fr wl, se ne 35-2n-8e, ¾ mi extension.	8-12-47	3087	3076-	McClosky li; Miss	P 72	.....
Wayne	Geff, W	A. J. Slagter's J. T. Haynes 1, se ne sw 4-1s-7e, ¾ mi n extension	8- 5-47	3172	3105- 3137	Aux Vases sd; Miss	P 42; 3 wtr	.....
Wayne	Johnsonville,	Puritan Drlg. Co's B. Spicer 1, nw nw sw 24-1n-5e, ½ mi w extension	8- 5-47	2973	2954-	Aux Vases sd; Miss	P 200; 65 wtr	.....
		INDIANA—New Oil Field						
Crawford	Birdseye, E	Harlan L. Kays' Willard M. St. Clair 1, ne se ne 31-2s-2w	7-16-47	995	985- 994	.....	P 6	.....
		KANSAS—New Oil Fields						
Barton	.....	Bridgeport Oil Co's Hunt 1-A, ne ne ne¼ 32-17s-14w, 1 mi w Boyd pl.	8- 2-47	3473	3250- 3473	Lansing li; Penn	P 180; 14 wtr	.....
Graham	.....	Wilcox Oil Co. et al's Rush 1, ne nw ne 9-6s-22w, 10 mi sw Ray, W. pl.	8-27-47	3873	3487- 3617	Lansing li; Penn	F 297	33
McPherson	.....	Mallard Oil Co. et al's Hofsommer 1, nw nw se 6-18s-1w, 3 mi nw Paden pl	8- 7-47	2800	2741- 2800	Mississippi chat; Miss	P 215; 50 wtr	.....
Rooks	.....	Continental Oil Co's Gilbert 1, ne ne se 6-9s-18w, 1 mi e Barry pl.	8-27-47	3498	3487- 3498	Arbuckle li; Ord	P 609	.....
Stafford	.....	Sohio Oil Co's Schrepel 1, se se se 12-21s-12w, 2 mi ne Saundra pl.	8- 2-47	3515	3480- 3515	Arbuckle li; Ord	P 363	.....
		NORTH LOUISIANA—New Oil Field						
Union	Ora, S	R. T. Sellars & Wilson Ewing's P. J. Tucker 1, c nw nw nw 3-21n-1w, 1½ mi s Ora fld.	8- 7-47	2565	2141- 2150	Nacatoch sd; U. Cre	F 90; 1/4"	.....
		SOUTH LOUISIANA—New Oil Pays						
Plaquemines	Lake Hermitage	Gulf's Lafourche Basin Lev. Distr. 17, 1650 s alg el Sect 10 fr nec th 660 w at ra to said line in 10-18s-25e.	7-10-47	12091	11895-11954	.....	F 91; 3.2 mln 1/4"	38.7
Plaquemines	Venice	Tide Water's Buras Levee Distr. 36, nec 28-21s-30e	8-14-47	12568	12552-12568	.....	F 313; 1/4"	32.3
		SOUTH LOUISIANA—New Distillate Pay						
Cameron	Mud Lake, NE	Magnolia's Vincent Est. 1, sec sw 18-14s-10w	8-13-47	10950	9937-10085	.....	F 39; 2.8 mln; 1/4"	44.1
		MICHIGAN—New Oil Field						
Crawford	.....	Pure Oil Co's State A-1, w½ sw nw 17-25n-4w, 6 mi ne Norwich, E. fld.	8-19-47	4410	4229- 4328	Richfield dolo; Devo	SW & F 100; 10 wtr	.....
		MONTANA—New Oil Field						
Carbon	Elk Basin, NW	Sinclair-Wyoming Oil Co's Wilkins 1, nw sw nw 28-9s-23e, 1½ mi nw Elk Basin fld.	8-20-47	6795	6215- 6795	Madison li; Miss	F 4942; 2"	32
		MONTANA—New Gas Pay						
Liberty	Witlash	Western Natural Gas Co's Iverson 3, cwl se se 3-37n-4e, ¾ mi ne fr prod.	8- -47	2857	2832-	Cut Bank sd	5 mln	.....
		OKLAHOMA—New Oil Fields						
Cotton	.....	Amerada Pet Corp's Per-mam-su 1, se sw ne 35-3s-11w, 1 mi n Cache Crk. pl.	8- 6-47	1413	1402- 1407	Pennsylvanian sd; Penn	P 4; 32 wtr	34.4
Murray	.....	Sohio Pet Co's Purtle 1, se se ne 23-1n-2e, 10 mi s Lewis pl.	8-15-47	1567	1490- 1540	Basal McLish sd; Ord	P 346	16.1
Noble	.....	Davon Oil Co's Tauffest 1, ne sw nw 32-24n-1e, 6 mi e Tonkawa pl.	8-24-47	4526	4307- 4316	Bartlesville sd; Penn	P 10	.....
Oklahoma	.....	Harper & Turner et al's Hyden 1, se se nw 10-14n-3w, 1 mi n Edmond, NE pl.	8-16-47	2561	2516- 2561	Wilcox sd; Ord	P 185; 116 w	.....
Pottawatomie	.....	E. H. Van Patton et al's Chapman 1, nw se nw 1-10n-4e, 4 mi w Earlsboro, N. fld.	8-26-47	4147	4124- 4147	Bartlesville sd; Penn	P 78; 180 wtr	31.7
Stephens	.....	Skelly Oil Co's Browder 1-A, se sw se 30-1s-4w, 1 mi e Velma pl.	8-25-47	7514	6982- 7112	Pennsylvanian sd; Penn	P 281	28
		OKLAHOMA—New Gas Fields						
Hughes	.....	J. T. Hall's Burkett 1, sw sw se 34-8n-10e, 2 mi sw Greasy Creek dist.	8-27-47	1968	1960- 1962	Bartlesville sd; Penn	1.5 mln	.....
Hughes	.....	Mid-Continent Pet Corp's Winters 1, sw sw sw 25-9n-10e, 2 mi e Wetumka, S. pl.	8-28-47	2272	2238- 2272	Booch sd; Penn	1.9 mln	.....
		TEXAS—District 2 (Middle Gulf Coast)—New Oil Field						
Calhoun	Green Lake	Ryan Consolidated Pet. Corps' Theresa H. Wagner 1, 1500 fr sel, 11,250 fr nel Manuel Lopez Gr A-25, 2 mi ene Green Lake twst.	6- 2-47	6097	5980- 6008	Marginulina sd; Olig	F 33; 1/8"	40.6
		TEXAS—District 2 (Middle Gulf Coast)—Oil Field Extension						
Bee	Yoward	Mills Bennett & Anderson-Prichard's W. Sherwood 1, 660 fr sel, 6700 fr nel of H. Coley sur, 1 mi nne of disc.	7-20-47	7653	7507- 7510	Slick sd; Eoc	F 44; ¼"	45
		TEXAS—District 2 (Middle Gulf Coast)—New Distillate Fields						
Calhoun	.....	Cecil H. McSpadden's Mary R. Goggans 1, 4000 fr sel, 18,500 fr swl Benito Morales Sur A-28.	8- 8-47	6220	5766- 5770	.....	F 375; 30 mln; open	62.5
Calhoun	.....	Quintana Pet. Corp's L. J. Foester 1, 330 fr nwl, 8600 fr nel, Y. Benavides sur	8-10-47	10064	7920- 7941	.....	F no gge; 4 mln; ¼"	.....
Goliad	Heinzeville	Dan Auld et al (J. C. Hawkins)'s, F. W. Heinrich 1, 2200 fr ne & sl's Cyrus Donnely Sur.	8-10-47	7774	7556- 7566	Slick sd; Eoc	F 108; 3.2 mln; ¼"	.....
Live Oak	.....	Continental Oil Co's Kittie West Burns 1, 1650 fr ne & sel's of G. L. Haas Sur A-223, 2 mi ne of Clay West fld.	7- 2-47	10338	10170-10190	.....	F 3; 2.5 mln; 1/8"	.....

TABLE CONTINUED ON PAGE 84

ORBIT FORGED STEEL VALVES

Fig. No. F-2015,
2"-1,500 lb. test

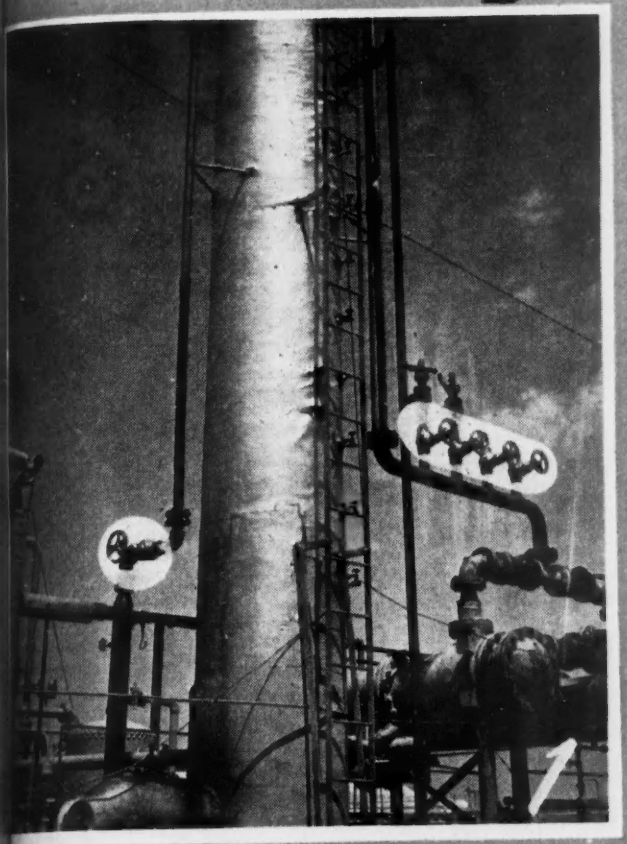
Orbit Forged Steel Flow Line Valves equipped with stainless steel stems are giving longer service on lines handling *high volatile* liquids and *corrosive* vapors.

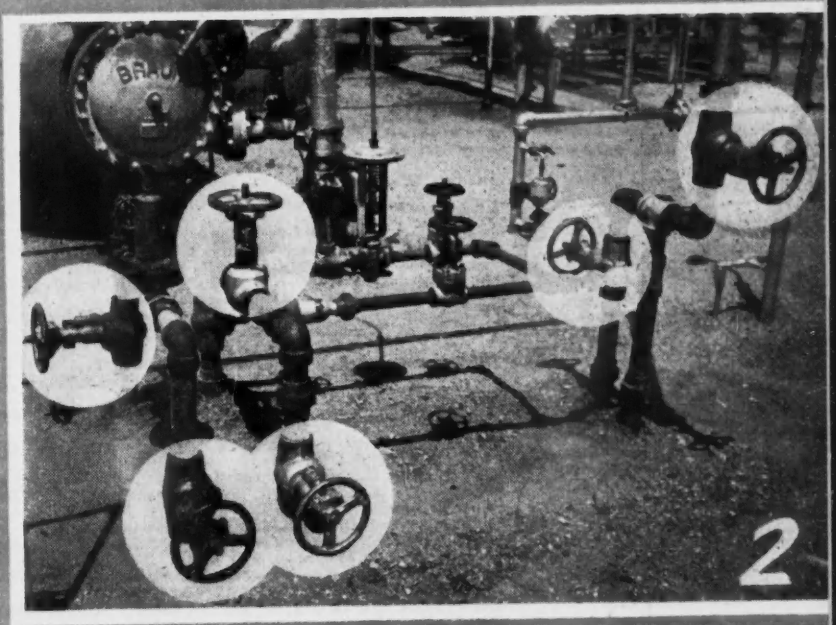
The homogeneous nature of the forgings, welded bonnet construction, plastic packing and the isolation of the lubricant from the body cavity make this an ideal valve for use in gasoline plants and gasoline absorption plants where temperatures do not exceed 275° F.

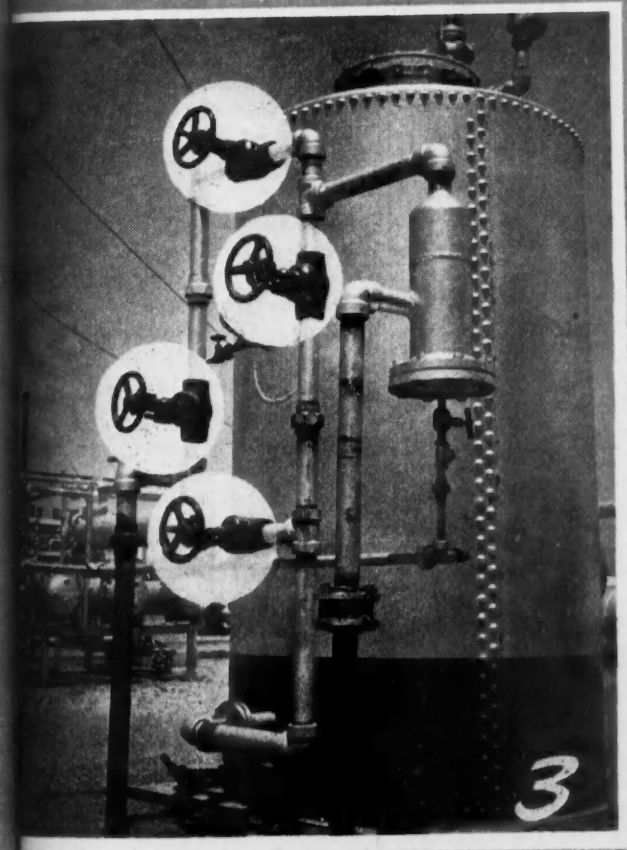
The 2"-1,000 lb. test pressure Orbit Forged Steel Valve is recommended for use on loading racks, bulk storage and lines handling gasoline, butane, propane, etc.

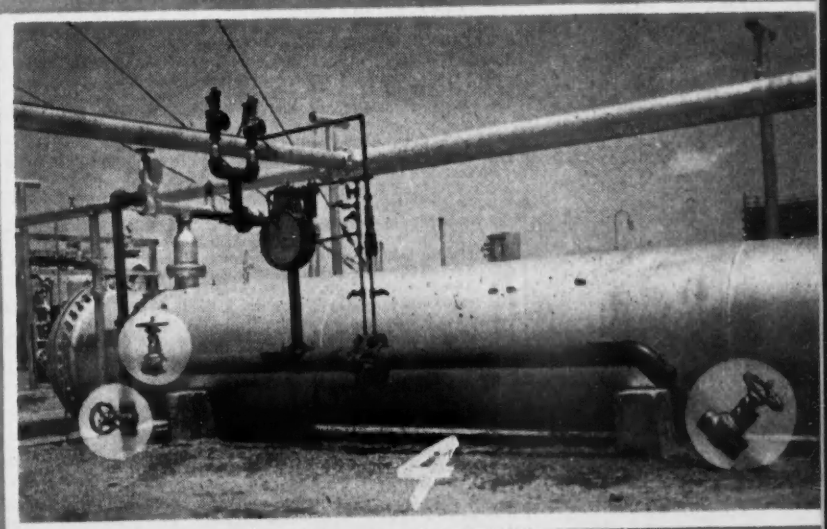
The installations shown here are all Orbit Forged Steel Valves No. F-201, 2"-1,000 lb. test pressure, equipped with stainless steel stems. This valve is available with screwed ends or flanged ends.

another tough problem ... in the manufacture of L.P.G.









1 Service—propane stabilizer.

2 Service—by-pass manifold for a gasoline treater.

3 Service—reverse-flow header on gasoline treater.

4 Service—stabilizer vapor measuring station.

When ordering Orbit Valves for this service specify stainless steel stems.

ORBIT VALVE COMPANY

Export Representative: Jones & Laughlin Supply Co., 230 Park Ave., New York 17, N. Y.

TULSA 1, OKLAHOMA

New Oil, Distillate and Gas Fields and New Pay Horizons Discovered in the United States in August, 1947

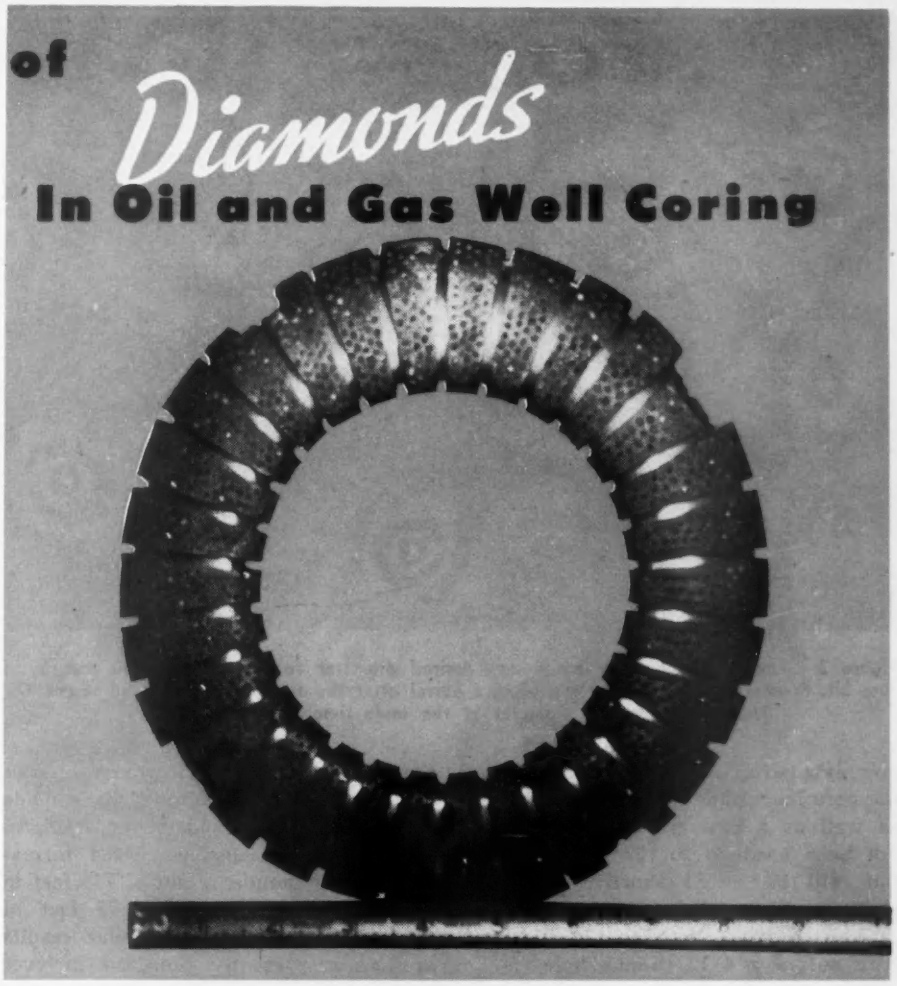
Also Important Extensions to Established Fields

COUNTY	FIELD	COMPANY, WELL AND LOCATION	Date Completed	Total Depth (Feet)	Completion Horizon (Feet)	[1]Name, Character and Age of Producing Formation	[2]Initial Production Method and Choke	Gravity of Oil
		TEXAS—District 2 (Middle Gulf Coast)—New Distillate Pays						
Jackson	La Salle	Sterling O&R Co's J. M Bennett 1-Y, 550 fr nwl 450 fr swl 80-ac lse, Ramon Musquez Gr. Lot 32, J. M. Bennett 1st Sbdn.	8-10-47	7720	6298- 6314		F 65; ¼"	51
Refugio	La Rosa, N.	Phillips Pet. Co's S. Bill 1, (OWWO) 660 fr el 330 fr sl of n½ se¼ Sect 40, Johnson & Pugh Sbdn of Bonnie View Reh on 80-ac lse.	8- 5-47	9203	5633- 5642		F 75; 1.6 mln; 1/16"	....
		TEXAS—District 3 (Upper Gulf Coast)—New Oil Field						
Tyler	Wurtsbaugh	American Republics Corp's Kirby Lumber Co et al 1, 660 fr nl & n'ly el of Sara Fields Sur A-802, 3 mi n Beach Creek, N. prod.	7-21-47	10757	9070- 9078		F 58; 44 wtr; ½"	42.9
		TEXAS—District 3 (Upper Gulf Coast)—New Oil Pays						
Matagorda	Sugar Valley	Humble's Truitt & Gravier et al 1, 9340 fr swl 467 fr nwl Freeman George Sur.	8-15-47	11486	9970- 9975		F 199; ¼"	28.4
San Jacinto	Cold Spring	Butcher-Arthur's Foster Lbr. Co. 2-D (OWWO) start s cor Polk CSL Sur, go nw alg swl 1300 th sw at ra 1800 to len in Geo. Taylor Sur.	8- 8-47	7865	4414- 4422		F 107; 1/32"	41
		TEXAS DISTRICT 3 (UPPER GULF COAST)—New Gas Pay						
Wharton	El Campo	Seaboard Oil Co of Del's B. R. Holub 1-B, 467 fr n&el of s 100-ac of "B" 200-ac lse, W. D. Ivey Sur A-516, Sect. 48. 2000 fr nearest gasser.	7-18-47	7726	6094- 6101		3.2 mln ¼"	....
		TEXAS DISTRICT 3 (UPPER GULF COAST)—New Distillate Field						
Wharton	West Bernard	Tide Water's J. D. Hudgins 1, 1980 fr nwl 660 fr nel blk 39, 5 mi se Lissie prod, 5 mi ne Egypt gas prod.	8-13-47	7901	6708- 6723		F 40; 2.9 mln; ¼"	57.7
		TEXAS DISTRICT 3 (UPPER GULF COAST)—New Distillate Pay						
Colorado	Englehart	Shell's J. H. Hudson 1, 3400 fr nwl 1100 fr swl Kennelly Sur and c of 40-ac unit out of 282.5-ac lse.	8- 8-47	11820	8882- 8890		F 80; 2.2 mln; ¼"	53.6
		TEXAS—District 3 (Upper Gulf Coast)—New Gas Field						
Wharton		Jack W. Frazier's Fred Swenson 1, (OWWO), 466 fr n&el 67-ac tr, Jas. Devers Sur.	7-14-47	5500	4803- 4811		16.7 mln; open	....
		TEXAS— District 4 (Lower Gulf-Southwest)—New Oil Fields						
Duval		Gravis & Mitchell et al's Robert Schallert 1, 2202 fr el 608 fr nl Sur 255, 6 mi n Benavides on nw flk of Palagana salt dome.	7-25-47	3029	1770- 1785		P 150	....
Duval		Edwin B. Cox-Jake L. Hamon-Geo. H. Coates' Jas. R. Dougherty 1-A, 330 fr nel 2900 fr nwl Eliz. J. Gravis Sur 508.	8-18-47	3316	2276- 2280		F 23	22
Starr		W. B. Jewel Osborn-Mid-Continent Pet's John Clopton 1, 467 fr wl, 665 fr nl at ra of Lot 19, Blk 2, B & B Oil Co. Sbdn, Porc 86.	8- 1-47	6256	5660- 5700		F 1; 0.2 mln; open	....
		TEXAS— District 4 (Lower Gulf-Southwest)—New Oil Pays						
Brooks	Alta Mesa	Standard of Tex's Mestena O&G Co. 1, 3252 fr el 3504 fr nl 2556-ac lse, La Mestena Gr.	8- 7-47	5907	4517- 4520		F 110; 1/16"	46.9
Duval	Squire	Santa Clara Oil Co-John F. Camp & Sons' Jas. F. Welder Hrs. 3-C, 1000 fr sel 1150 fr nel M. G. Nunez Sur 4, 2000-ac "C" lse.	8-17-47	3280	3215- 3228	Strake sd	F 239; 1/32"	....
Nueces	Bishop	H. R. Smith-W. C. McBrides' King Reh 1, 1850 fr swl 1750 fr sel Sect 152, Bishop Sbdn, Weil Reh. Palo Alto Gr.	8-12-47	8320	7800- 7834		F 66; 1/32"	41
San Patricio	Sinton, W.	Arnold O. Morgan Oil Co's H. S. Smith 1, (OWWO) 660 fr wl 330 fr sl, 22-ac lse in Blk 22, J. J. Welder & Coleman-Fulton Pstr Co. Sbdn, Jno. Pollan Sur A-23.	8- 6-47	7021	1490- 1495		F 45; 27 wtr; ¼"	20.6
		TEXAS—District 4 (Lower Gulf-Southwest)—New Distillate Pays						
Brooks	La Gloria	Magnolia's Lot mann Hrs. 1, 330 fr el 990 fr sl, Lot 5, Blk 4, Falfurrias Fm & Gdn Trs, Sbdn on 85.73-ac lse, se flk of fld.	8-28-47	9200	8795- 8828		F 39; 90 wtr 2.5 mln; 1/8"	....
Nueces	Flour Bluff	Humble's J. O. Phillips 9, 660 ne of swl lot 1, Blk 55, Flour Bluff & Encinal Fm & Gdn Tr on 160-ac lse.	8-12-47	9030	8288- 8298		F 16; 0.8 mln; 1/8"	51.6
Nueces	Luby	Seaboard's James Luby 22, (OWDD) 5300 fr el 3200 fr sl Canutillo Colony Ditch Co. Sur 1179-ac lse.	8-10-47	7028	6840- 6850		F 322; 21.5 mln; open	....
		TEXAS—District 4 (Lower Gulf-Southwest)—New Gas Pay						
Jim Hogg	East	Texas Co's A. K. East 1, 330 fr e&sl lot 14, Blk 2, T. T. East Sbdn, 5731.3 ne of sec of Blk 3.	8- 1-47	4975	3955- 3959		9 mln; open	....
		TEXAS—District 6 (Northeast)—New Distillate Field						
Wood	Yantis	Humble's Rio Oil Corp 1, 1980 fr ewl 660 fr snl 683-ac Tr, or 1980 fr ewl 6300 fr snl Jesse Walker Sur, 8 mi w by s of Coke fld.	8-15-47	8510	7932- 7950	Rodessa (Gloyd) li; L Cre	F 443; 5.6 mln	62.1
		TEXAS—District 6 (Northeast)—New Distillate Pay						
Wood	Hawkins	Humble's P. H. McKnight 1, 660 out swc of W. R. James Sur, A-335, ½ mi n of ne edge Hawkins fld's Woodbine area.	8- 1-47	14629	8935- 8970	Rodessa li; L Cre	F 54; 1.1 mln; open	....
		TEXAS—District 7-B (North Central)—New Oil Fields						
Jones		Delhi Oil Corp's A. Neumann et al 1, 2856 fr m/nly/nl 330 fr m/wly/wl Sect 52, Blk 18, T&P Sur.	8-12-47	4576	2928- 2934		P 40	38
Jones		Frank Wood and A. R. Dillard's Hattie Connally 1-A, 660 out swc Sbdn 1, Blk 4, A. W. Hill Sur.	7-22-47	2032	2029- 2032	King sd; Penn	P 21	40
Shackelford		Big West Drlg Co.-Tevis F. Morrow's T. G. Hendrick 1, lse, 12, Structure "A" 3997 fr ewl 3207 fr snl Sbdn 8, AB&M Sur. 1½ mi s gasser.	7-27-47	5263	5257- 5263	Ellenburger dolo; Ord	P 156	41
Throckmorton		West Central Drlg Co.-F. L. Wilson-George Rice et al's J. B. Putnam 1, 1606 fr ewl 990 fr sel McKinney-Williams Sur A-234.	6-12-47	695	670- 690	Tannehill sd; Perm	P 32	36
		TEXAS—District 7-B (North Central)—New Oil Pays						
Haskell		McCarthy O&G Corp's T. G. Hendrick 1, 660 fr nsl 330 fr ewl of A. Rodriquez Sur A-350, near dry gassers.	8- 2-47	1769	1753- 1769	King sd; Penn	P 12	38
Jones	Sayles-Strawn	Condor Pet. Co's Henry Sayles 44, 330 out of m/w/nw cor T&P Ry 3, Blk 2	8- 7-47	5080	3889- 3915	Strawn sd-li; Penn	P 11; 5 wtr	40.6
Jones	Pitser	Roark, Hooker & Roark's Lillie P. Brown 1, 304 fr el 752 fr sl Blk 32, DeWitt CSL Sur Lge 150.	8-12-47	4265	4248- 4256		P 35; 6 wtr	39
		TEXAS—District 7-C (West Central)—New Oil Field						
Crockett	Childress	Humble's E. Mitcham 1, 810 fr snl 660 fr wel D&SE 12, Blk AB.	8-14-47	8165	8092- 8122	Ellenburger dolo; Ord	F 488; ¼"	41.6
		TEXAS—District 7-C (West Central)—New Oil Pay						
Runnels	Leonard	O. P. Leonard's Floyd Thompson 5, 2270 fr sl 660 fr wl Sect 109, Blk 28, ET RR Sur.	7-16-47	3404	3400- 3404	Gardner sd	F 80; ½"	43
		TEXAS—District 7-C (West Central)—Oil Field Extension						
Schleicher	Page	Al. P. Groebl et al's Koy 1, c nw sw GH&SA 34, Blk L, 1 mi ne extension	7-20-47	5702	5470- 5485	Strawn li; Penn	P 55; 29 wtr	40.
		TEXAS—District 8 (West)—New Oil Pay						
Ector	Goldsmith-Ellenburger	Gulf's Goldsmith 430-E, 1992 fr snl 2001 fr ewl T&P Ry 15, Blk 44, T-1-S, ⅝ mi nw depleted Devonian disc.	8-21-47	9645	9495- 9535	Ellenburger dolo; Ord	F 301; 1/16"	46.8
		TEXAS—District 8 (West)—New Gas Pay						
Andrews	Andector	Plymouth Oil Co's R. B. Cowden 1-1, (OWWO), c sw sw T&P 1, Blk 45, T-2-N.	7-28-47	8767	4220- 4250	San Andres li; Perm	7 mln 2"	....
		TEXAS—District 9 (North)—New Oil Field						
Clay		L. T. Burns et al's W. T. Talley 1 2310 fr snl 1650 fr wel Sbdn 12, J. H. Belcher and M. Haley Sur. 1½ mi sw Joy fld and separated by failures.	7-31-47	4466	4449- 4466	Strawn sd; Penn	F 217; ¼"	43
		TEXAS—District 9 (North)—New Oil Pays						
Clay	Bryant Edwards	Grace and Grace et al's Bryant Edwards 1, 467 out of nwc Sect 41, Marion CSL, ⅝ mi se of 6196-ft Bend prod.	8- 2-47	6340	6315- 6340	Simpson li; Ord	F 1440; 1/32"	41
Montague	Rogers and Rogers	L. A. Conner Oil Co's W. L. Reed-Sunray 3, 4750 fr nsl 850 fr ewl J. D. Jennings Sur A-389.	7-28-47	3415	3394- 3414	Strawn sd; Penn	F 94; ¼"	42
		WYOMING—Oil Field Extensions						
Fremont	Sand Draw	Sinclair-Wyoming's Unit 5, sw ne sw 14-32n-95w, ¾ mi se extension	8- -47	7996		Tensleep sd; Penn	F 3151; 1"	....
Niobrara	Ant Hills	Arrow Oil Co's Wasserberger 1, sw ne sw 1-37n-63w, 4 mi n extension	8-18-47	4826	4725- 4732	Newcastle (Muddy) sd; U Cre	P 104	42
Weston	Mush Creek	Morton Oil Co's Sedgewick 1, c ne ne 17-44n-63w, 1½ mi w extension	8- -47	4165	4155- 4165	Newcastle sd; U Cre	P 255	42
		WYOMING—Gas Field Extension						
Sweetwater	Table Rock	Texas Co's Unit 3, c nw se 2-18n-98w, 1 mi sw extension	8- 9-47	3950	3370- 3381	Wasatch sd; Eoc	5.5 mln	....

[1] Character of producing formations abbreviated thus: ch, chalk; dolo, dolomite; li, limestone; sd, sandstone; sh, shale; ser, serpentine; cgl, conglomerate. Ages of formations abbreviated thus: Plio, Pliocene; Mio, Miocene; Olig, Oligocene; Eoc, Eocene; U. Cre, Upper Cretaceous; L. Cre, Lower Cretaceous; Jur, Jurassic; Tri, Triassic; Perm, Permian; Penn, Pennsylvanian; U. Miss, Upper Mississippian; L. Miss, Lower Mississippian; Devo, Devonian; Sil, Silurian; Ord, Ordovician; Cam, Cambrian.

[2] Barrels of oil per day (24 hr. rate), flowing (F), pumping (P), swabbing (Sw), or bailing (B); or million cubic feet of gas daily open flow capacity; size of choke given in inches.

Source and Use of Diamonds In Oil and Gas Well Coring



The use of "black" or "commercial" diamonds in the oil industry represents an important advance in coring and drilling technique. Bits in which black diamonds are mounted have been used with success in the Rocky Mountain and Mid-Continent areas not only to recover almost 100 percent of cores cut but also to cut hole at a substantial savings in time and money.

By CARROLL DEELY

ALTHOUGH diamonds are usually thought of as gems for the wealthy, many of the diamonds mined in South Africa, Brazil and other places in the world are unfit for use as gems, because of imperfect crystal structure or discoloration. These "black" or "commercial" diamonds have been used by diamond cutters, tool makers and precision instrument makers for many years.

About 95 percent of the world's commercial diamonds are mined in the African continent. The remainder are produced in Brazil, British Guiana, Venezeula and India, while deposits have been found in Borneo, Australia, the U. S. (Arkansas) and a few other countries. The four main grades of commercial diamonds are: Bortz, Congos, Carbonados, and Ballas.

The diamond is the hardest substance known, having a hardness of ten on the Mohs scale of hardness, or many times harder than the hardest known commercial substance. The greatest use of diamonds at the present time, by weight, is in diamond grinding wheels. Other industrial uses include wheel dressing tools, boring and turning tools, contact points, precision gauges, wire-drawing dies, stone saws, etc.

Figure 1. Newest and largest diamond core bit made. Cuts 4⅞-inch diameter core out of hole ranging in size from 8¼ to 9 inches. The core barrel on which this bit is used is 7⅝-inch O.D.

Diamonds have been used for small diameter coring of mining properties for years. They also have been used for small diameter coring for geological data on oil prospects; but diamond drilling for oil with full-sized bits has been in the experimental stage until the last few years, when diamond coring for reservoir information began in fields such as West Edmond, Oklahoma, and Rangely, Colorado. In the latter field, diamonds are useful not only for high core recoveries, but also as a means of reducing the cost per foot and number of rig days to complete a well in the thick Weber sand pay zone.

Table 1 shows most of the formations that have been cored by diamond bits to the present time. Figure 1 shows the newest and largest diamond core bit yet built. It is designed to cut a 4⅞-inch core out of an 8⅝-inch hole, and contains about 340 carats of diamonds. It is to be used in connection with a newly-designed core barrel that can handle the larger core in an 8¼ to nine-inch hole. Another core barrel is being designed for operation in a seven to eight-inch hole. This will allow an operator to obtain core barrels in a complete range of five sizes, to accommodate bits ranging in size from 4½ to nine-inch diameter. Every effort is being made to keep the ratio of the outside diameter to the core size as small as possible, so that the rate of penetration will remain high and the bit cost will remain as low as possible.

The Reamer

Figure 2 shows a diamond reamer that has been designed to enlarge core holes made by smaller bits such as the 6⅛-inch diamond core bits, which are

About the Author: Development of the diamond core bit and drill has become a fascinating lifework for Carroll Deely of Drilling & Service, Ltd., Dallas. He first became interested in its possibilities more than ten years ago when he joined the old Midwest Refining Company and was assigned to the diamond core drilling department. In his Dallas office visitors are shown stacks of diamond studded bits which are kept in a flimsy wooden cupboard and Deely delights in explaining all about them, remarking that each of the bits are valued at from $1700 to $1900.

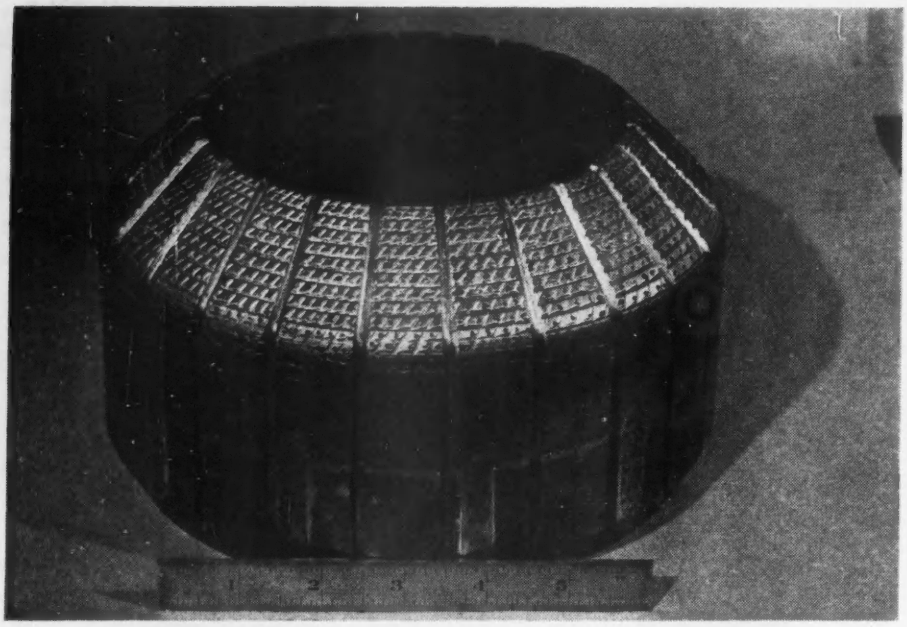


Figure 2. Reamer that can be made any desired diameter to enlarge the hole cut by a core bit. Reamer attaches to the top of core barrel after the first core is cut and reams the hole to the desired diameter at the same time coring progresses.

now extensively used. It will run above the core barrel and serve as a stabilizer as well as a reamer. The reamer has not been used up to the present time, but will be tested shortly. Figure 3 shows a bit used for reverse circulation at Rangely that cuts a 2¼-inch core out of a 4 13/16-inch hole.

Experiments have been conducted in the past with full hole, or solid, diamond bits, in an effort to eliminate the trips necessitated when coring. The results so far have been discouraging because the center of the bit fails, as evidenced in Figures 5 and 6. As noted, diamond core bits perform best when the ratio between the core diameter and hole diameter is at a minimum, because the difference between lineal feet traveled per minute on the outside diameter and inside diameter of the bit is small enough to insure peak diamond performance. In the solid bit the dead center diamonds practically stand still, while the outside diamonds are traveling at the correct cutting speed. Consequently, the outside of the bit cuts itself free, imposing an overload on the center diamonds which crushes and destroys the center portion of the bit.

Core bits 6⅛-inch in diameter as shown in Figure 4 have made records of over 700 feet per bit at Rangely, but the importance of these runs is minimized by the fact that drilling conditions in this area are a diamond-drilling paradise and perfect for this operation. Some features which help diamond bit performance are a cased hole, clean drilling fluid, operators thoroughly familiar with diamond drilling, and homogeneous formations such as sandstone. All of these conditions are present at Rangely. However, bits of the type shown in Figure 4 have made comparable footages in other areas, in open holes and unconsolidated formations. For example, a run of 746 feet in Oklahoma, which included 73 feet of chert; and furthermore, similar results are being presently obtained in ever widening operations through all areas. These results are of great importance to operators when deciding whether or not to use diamond drilling.

Coring time through certain formations varies greatly with the area in which the formation is cored. For example, two wells were cored recently through the Drinkard pay zone in the Eunice field, New Mexico, where 3¾-inch cores were taken out of a 6⅛-inch hole, and recovery in both wells was 100 percent. The coring time on one was approximately 25 minutes per foot, however, compared with seven minutes per foot on the other, which was several miles north of the first well.

Reverse Circulation

Reverse circulation has been used satisfactorily with diamond coring at Rangely, to eliminate trips while coring the thick Weber pay zone. A well was completed recently by this method through 399 feet of formation without making a single round trip. Core recovery was 100 percent, and the bit was still in good condition when pulled.

The cores were broken off and pumped up to a special catcher below the kelly, so that they could be removed when making connections. Results of coring by reverse circulation have indicated that this method is feasible only in cased holes and consolidated formations. In uncased holes, the hazard of pumping cavings and other debris around the bit is present, and fractured cores will not travel freely up the drill pipe. The liklihood of extra trips is therefore increased, and the advantage of the method would be minimized.

One oil company recently decided to deepen a 10,000-foot producing well, already cased with 5½-inch, 20-pound casing, by 600 feet through the McLish sand. A special diamond bit was made with an outside diameter of 4 23/32-inch and 3 1/16-inch I.D. to recover a 3-inch diameter core. This bit was used on a 4½-inch O.D. core barrel, 44 feet long. The well was deepened with a core recovery of 97 percent. Also, the rate of penetration was very fast, at times reaching three minutes per foot. This is an example of the close tolerance within which diamonds can be successfully used when necessary, due to the extremely fine cuttings produced by the diamond bit. It is doubtful if any other hole-making tool would have been successful under the same conditions.

Another operator has found that diamond coring in the North Lindsay field, Oklahoma, shows a saving of 13 or 14 days drilling time and about 40 percent drilling costs in the 440-foot Simpson sand formation. Whereas it took crews 23 days to drill this much hole, diamond coring required only nine days. The cores recovered were just an incidental advantage from an economic standpoint.

Diamond-coring time in a well near Whitehall, Mich., averaged ten minutes per foot through formations consisting of eight feet of Mississippian shale and 352 feet of Devonian limestone. The operator was able to pick the shale limestone contact accurately, which is an advantage of diamond coring much appreciated by operators in all areas. Penetration speed reached three minutes per foot in certain sections. The core recoveries were 100 percent, in spite of the formation being vuggy, cavernous, and badly fractured in many places. Cores 3¾-inch in diameter were taken with a 6⅛-inch O.D. bit.

The Devonian limestone in the new Leduc field in Alberta, Canada, was recently cored with a diamond bit, and although some difficulty was experienced with wedging in the core barrel, due to the highly-fractured nature of the lime, the core recovery was 95 percent of more than 300 feet cored. Vertical and almost vertical fractures in the lime allowed pieces of the core to jam in the inner tube of the core barrel. Part of the trouble might be attributed to the fact that the rig was not flexible

Here's the pitch that stays put!

Rex Chabelco Oil Field Chains keep their pitch under the toughest operating conditions. Precision made and finished parts are assembled into the Rex Unit Link by powerful, accurately controlled presses to assure heavy force fits at every desired point. They're put together to stay . . . will not develop the sloppy fits that cause premature wear on both chain and sprockets.

Look at the close-up at the right. Pin and bushing holes in the side bars are machine-finished for accuracy. Pins and bushings are carefully treated and ground to close tolerances for the precise fit that assures maximum strength and service life.

Here's why Rex Chabelco Chains keep their pitch . . . why the links remain a unit . . . why they last longer and give you the most service per foot of hole.

For all the facts and for application assistance, see the Rex Field Engineer or write Chain Belt Company, 1639 West Bruce Street, Milwaukee 4, Wisconsin. Rex Oil Field Chains are for sale in all oil fields.

REX Oil Field Chains

the chains that have grown up with the oil fields

CHAIN BELT COMPANY of Milwaukee

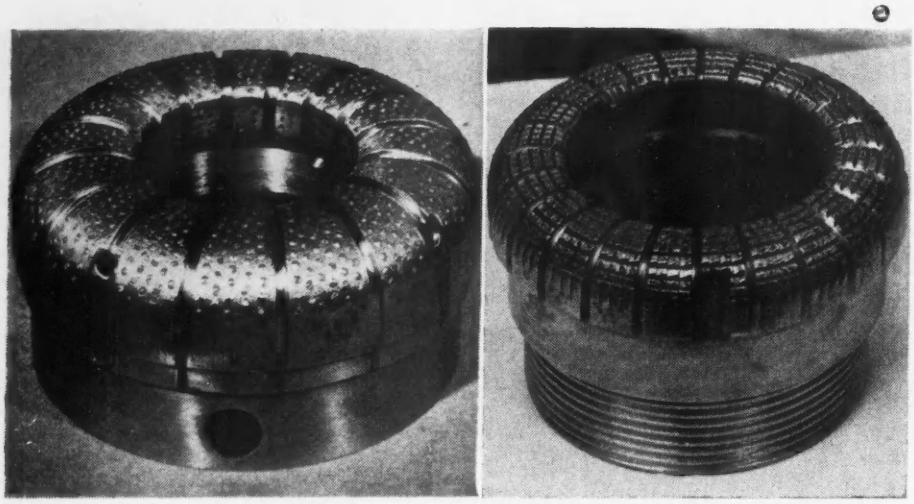
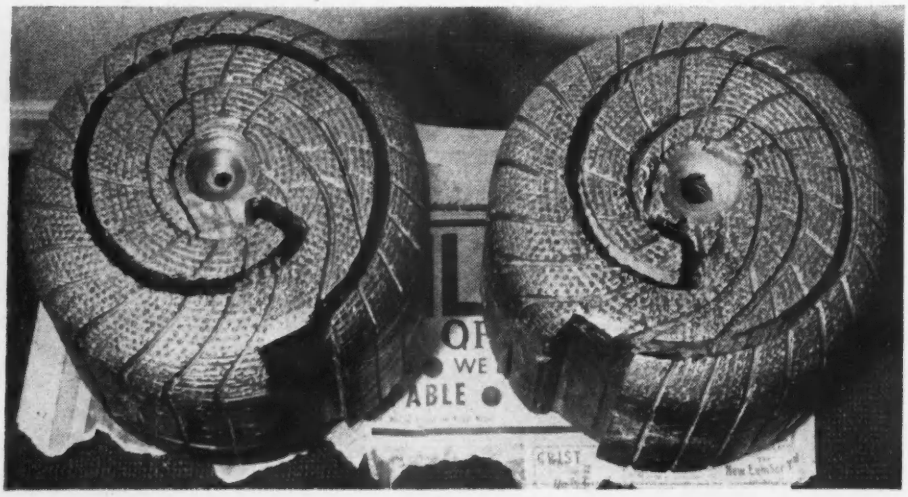


Figure 3 (top left). Reverse circulation diamond core bit that was used successfully in the Rangely, Colorado, field, cuts a 2¼-inch core out of a 4 13/16-inch hole.

Figure 4 (top right). Diamond bit first introduced in Rangely, Colorado, and in wide use in all areas, cuts 3¾-inch diameter core out of hole ranging in size from 5⅞ to 6¾ inches.

Figure 5 (center). Solid or full hole diamond bit with replaceable center. Bit on right has failed in center; on left is new replaceable center.

Figure 6 (lower). Two solid bits after use. Note how the center failed.



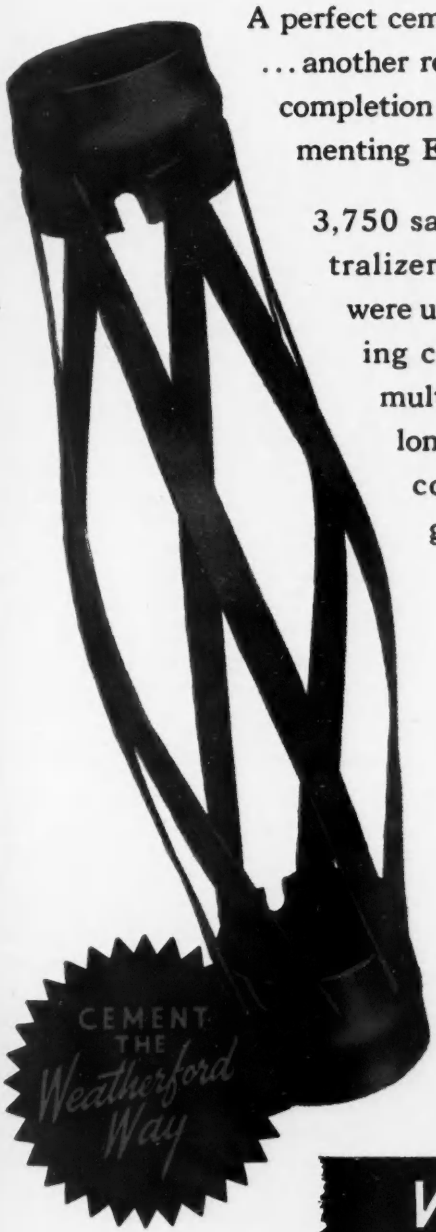
enough to permit reducing the mud pump volume sufficiently and yet maintain the desired rotary revolutions per minute to obtain the best results from the diamond core bit. Despite these operational difficulties, however, the coring was considered satisfactory.

When diamond coring deep formations in oil wells first began, it represented an effort to obtain greater core recovery, so that geologists and engineers could do a better job of completing the wells, estimating reservoir conditions, and computing the recoverable oil in place. Now, however, diamond coring in many fields has become a means of reducing the drilling time and cost of the wells. Cores are merely an added attraction.

TABLE 1
Formations Cored by Diamonds

STATE	Area	Formation	Approx. Depth, Feet
Texas	East	Travis Peak	8,500
		Cotton Valley	10,000
	North	Ellenburger	3,500
	Central	Caddo Lime	4,500
	West	San Andres	4,500
		Clear Fork	6,500
		Devonian	9,000
		Ellenburger	12,000
New Mexico	Southeast	Drinkard (Yeso)	6,500
		Paddock	5,200
		Clear Fork	6,500
Kansas	West	Mississippian	4,600
		Arbuckle	3,500
Colorado	West	Weber	6,000
Wyoming		Embar	7,000
		Tensleep	5,000
		Frontier	5,500
		Madison	4,500
		Morrison	13,000
Montana		Madison	6,000
Michigan		Mississippian	1,600
		Devonian	1,900
Indiana		Devonian	2,000
		Trenton	2,500
Oklahoma		Bromide	7,500
		Simpson	8,000
		Hunton	6,800
		Viola	4,800
		Bartlesville	2,000
		Woodford Shale	6,800
Louisiana	North	Cotton Valley	8,000
Alberta (Canada)	Turner Valley	Madison	7,500
	Leduc	Devonian	4,500

6,100 FT. CEMENT COLUMN!



A perfect cementing job on a 6,100 ft. column ... another record chalked up in a recent well completion by the use of Weatherford Cementing Equipment and Technique.

3,750 sacks of cement... 68 spiral centralizers... 412 reversible scratchers were used on this well. Despite the varying conditions encountered and the multiplicity of zones covered in the long cement column, the successful completion was achieved with great ease.

WEATHERFORD SERVICE

Thousands of wells, in all parts of the world, have been successfully completed with the use of Weatherford Equipment and Technique. This technique is offered you free of charge... a network of Weatherford field men is maintained to assist you with your cementing problems, wherever your job may be.

For Your Next Completion Job, Call Collect: Weatherford LD-1

Important

Ask about the new CEMENTING HEAD developed by Weatherford. This Head allows continued circulation and reciprocation . . . no interruption being necessary to operate valves or to drop the plug during the cementing procedure.

This Cementing Head is offered as a part of the Weatherford Service—no charge.

WEATHERFORD

Spring Company

WEATHERFORD, TEXAS

WEST COAST OFFICE
3316 JEWETT AVENUE, BAKERSFIELD, CAL.
TELEPHONE 4-4334

EXPORT OFFICE
617 SOUTH OLIVE ST., LOS ANGELES, CAL.
TELEPHONE: VAndyke 8409

Manufacturers of Oil Well Specialties • Telephones: 257 and LD-1

Pressure Welding

By A. L. BURNS, JR.

Houston Oil Field Material Company, Inc.

DEVELOPMENT of pressure-welding technique from the welding of line pipe and the affixing of upset end tool joints to drill pipe has progressed so that junctions are now made between sections of straight diameter material, and normalized by additional heat treating to attain or exceed the qualities of the original material. This article describes the machine which produces such pressure welds, and outlines the means whereby high grade welds are insured.

A NEW development in the manufacture of drill pipe, cutting and fishing tool pipe, and in the future of many drilling tools and appliances is the use of pressure weld bonds.

With this welding process thousands of miles of pipe line and several hundred thousand feet of drill pipe of high quality and at low cost have been produced. The future of this process in the manufacture of drilling tools has not even been scratched, but in many cases it will represent a real saving over existing methods and provide a trustworthy joint.

Pressure welding in substance is a simple process. Everyone remembers the blacksmith and his welding process of bringing metals up to a white heat and wielding a hefty sledge to form a union between the metals. Pressure welding is bringing this process up to date by butting carefully prepared surfaces together, maintaining a definite pressure on them and heating above the forging temperature. The applied pressure will then merge them into a homogenous joint.

Pressure welding of drill pipe must be considered on three points. First, can a joint be pressure welded on non-upset tubing or drill pipe which will be stronger than the drill pipe itself? Second, will the grain structure of the welded joint be suitable for the ductility and resistance to fatigue required of this pipe? And third, will the finished joint be economically feasible.

In respect to the first question of strength, repeated tests have indicated that the welded zone is definitely stronger than the drill pipe, even in non-upset drill pipe. The reason for this will be explained later when the technical aspects of pressure welding are discussed. Ductility and fatigue resistance are controlled by a specially built normalizing machine which normalizes only the heat-affected zone, leaving the tool joint hard and the drill pipe ductile and soft. The economics of pressure welding are effected by not requiring upset pipe, and elimination of drill pipe threads on the drill pipe ends and on the tool joint. Hence, pressure welding is desirable for this purpose from an economic standpoint.

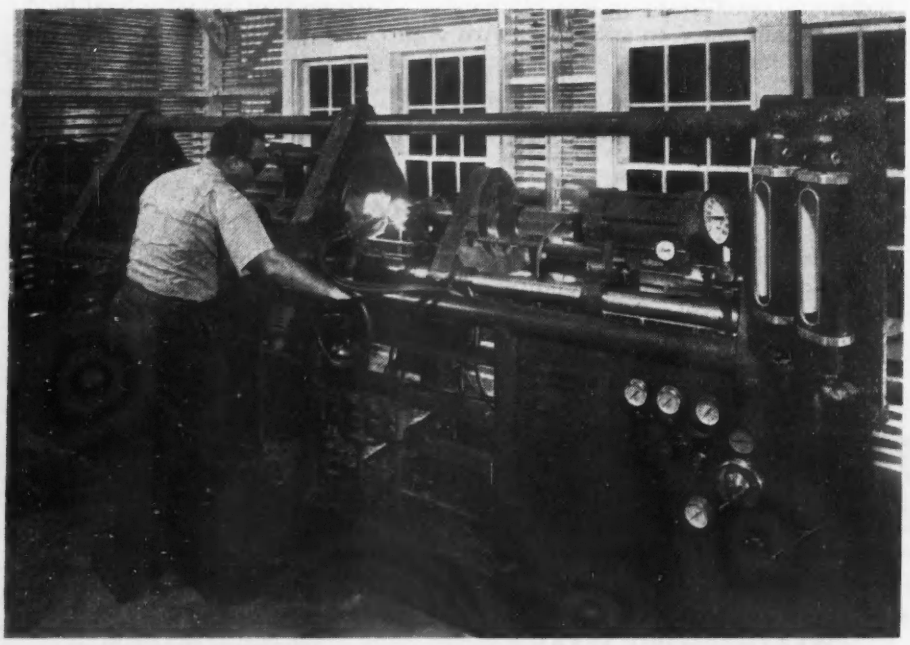


Figure 1. View of the pressure weld machine in operation. Weld is nearly completed as indicated by flying sparks.

The Pressure Weld Machine

The machine is approximately 13 feet long, 5½ feet high and 4 feet wide. The frame itself consists of six-inch H-beams for the base, and a framing structure of 3½-inch heavy wall tubing. Three plates 4½ inches thick surmount this frame, two of them carrying the hydraulic chucks, the other acting as the back plate for the welding cylinder. These plates are triangular in shape with 3½-inch heavy wall tubing carrying the tension loads from them.

The hydraulic system is a two-pressure system capable of 1000 pounds per square inch at 7.5 gallons per minute flow, and is driven by a ten-horsepower electric motor. The two pressures are necessary so that the chucking pressure can be independent of the welding pressure.

The two hydraulic chucks (for chucking the drill pipe) are of the three-jaw self-centering type. They are chucked

SMOOTHER RUNNING

with this Type G AMERICAN PACKER

Larger more efficient sealing area— for sealing in any type pipe

Smoother running

. . . because exclusive features of this AMERICAN Type G Packer provide ample internal fluid by-pass area for all safe running speeds!

Other features include . . .

● Simple American setting arrangement! ● Full tubing size opening through the packer! ● Extra large friction springs! ● Large, carefully heat-treated slips! ● Large bottom guide!

★ ONLY AMERICAN gives you the exclusive feature of a super cup packing element which is expanded laterally . . . not compressed! Other packers must depend upon compression of rubber to contain the seal!

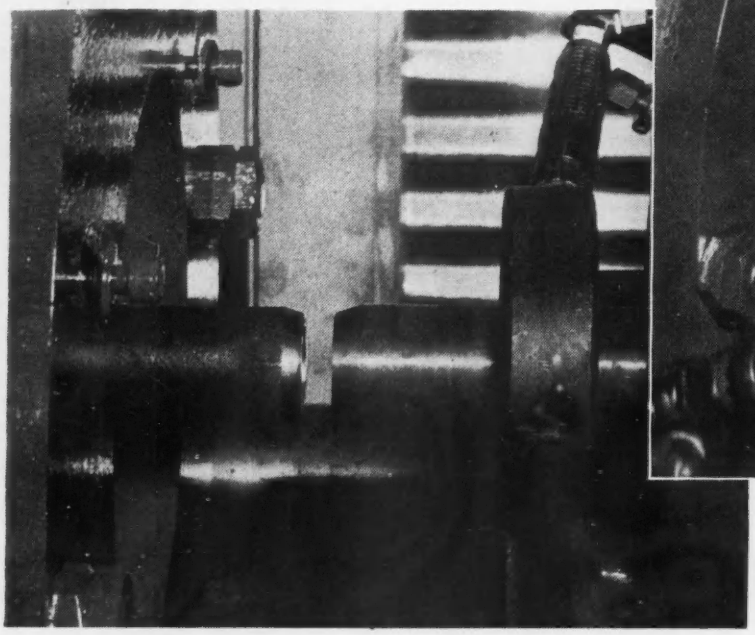
★ ALL THE SEAL is accomplished in ONE CUP . . . there is no additional, possible point of leakage! This fact, plus the larger sealing area of this AMERICAN packing element, also greatly overcomes interference from foreign matter such as steel cuttings or cement accumulations. This point alone puts AMERICAN'S Type G Packer ahead of all others!

Call us for RENTAL Drill Pipe and RENTAL Drilling Equipment! Remember, "American" has the largest, most widespread and diversified rental pipe stocks in the world!

AMERICAN
IRON & MACHINE WORKS CO.
OKLAHOMA CITY, OKLAHOMA
Office, Houston, Texas
Export Office: 420 Lexington Ave., New York City, N.Y.

REMEMBER, THERE IS AN "AMERICAN" SERVICE MAN IN EVERY ACTIVE FIELD!!

Figure 2 (below). View of pipe and tool joint ends prior to welding.



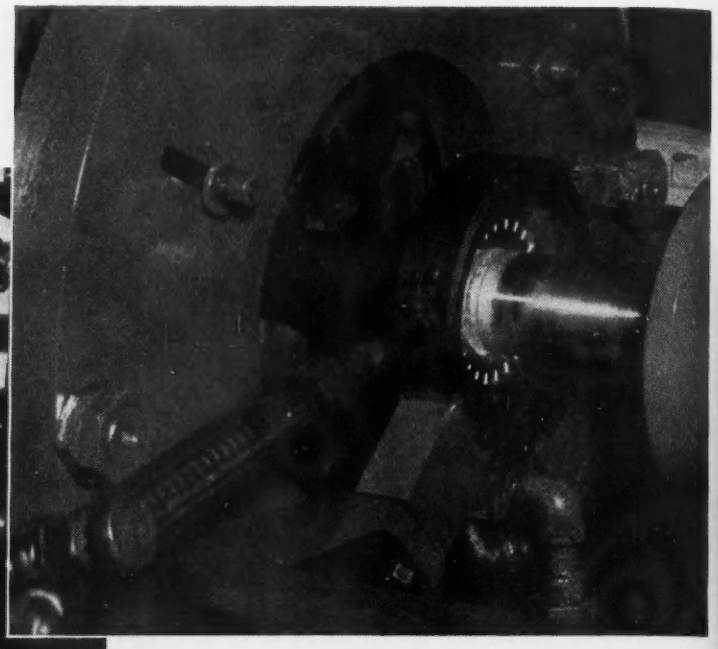


Figure 3 (above). View during the welding process. Upset has progressed until weld is slightly above the tool joint diameter.

and unchucked by a manually controlled four-way valve. Each size of pipe requires a set of jaws ground to the outside diameter of the drill pipe to avoid marring the pipe and to insure proper alignment.

The welding pressure is supplied by an eight-inch diameter piston which drives the pressure plate, holding the tool joint against the drill pipe. This pressure is regulated by a pressure reducing valve and must be accurately controlled. Movement of the cylinder is controlled electrically by the jog forward, forward and the limit switch.

The heat for welding is furnished by an oxygen-acetylene system. The heating head is circular, with the gas ports equally spaced on the inner periphery. The head is water-cooled through water circulating on each side of the gas ports at all times when the gas is flowing. This flow is controlled by a solenoid operated valve which is actuated by the flame button.

The oxygen and acetylene flow are controlled by regulators and indicated by flowraters, so that the actual flow in cubic feet per hour can be checked and controlled by the operator. The gas flow is started by the flame button and stopped by the limit switch. The heating head is oscillated 60 times per minute through a cam system driven by an electric motor and started by the rocker button.

The electrical system consists of the two motors mentioned before, one to drive the hydraulic pump, the other to oscillate the heating head, two solenoid operated valves, five push-button stations, and an upset limit switch. The five push-button stations consist of controls for the two motors (Pump and Rocker), one to provide temporary movement of the welding cylinder (Jog Forward and Reverse), Forward, which provides continuous movement of the welding cylinder until stopped by the upset limits switch, and Flame, which provides control of the gas and water until stopped by the upset limit switch.

Operation

The drill pipe, which has been prepared with an external and internal bevel and a smooth face, is fed into the machine, chucked, and carefully cleaned on the face with carbon-tetrachloride This is essential, as any impurities on the mating faces will cause voids in the weld. The tool joint, which also has been beveled externally and internally, is placed in the adaptor and cleaned on its mating face.

The jog forward button is pushed and the tool joint thus moved into contact with the drill pipe. Alignment is then carefully checked. The upset limit switch indicator is next set to zero on the indicator dial (the mechanism having been previously set for this pipe at the desired upset). The welding pressure is checked to be sure it is correct for this size pipe and welding is ready to begin.

The forward button is now pushed to start movement of the cylinder, the rocker button to start oscillation of the heating head, and the flame button to start oxy-acetylene flow and cooling water. A pilot gas flame is used to ignite the oxy-acetylene mixture and welding begins.

The operator carefully checks the oxygen flow by his flowrator. If it is correct the acetylene is checked to see that a slight acetylene feather is present in the flame. If not, the oxygen regulator must be adjusted until the flow is correct by the flowrator and the acetylene adjusted by eye.

The tips of the flames are now directed at the V formed by the bevels of the drill pipe and tool joint. After a very short time this V begins to change color. As it passes a light red color, upsetting begins and the V starts to rise very rapidly as the metal approaches a white heat, at which point externally it is above the tool joint. The upsetting and welding is now nearly finished. Several seconds later sparks will begin to fly and the flame and cylinder movement will be shut off by the upset limit switch. This is automatic and is set by imposing rigid heat and pressure controls in the initial setting. The weld is now completed. The jog reverse button is pushed and the tool joint comes out of its adapter. The pipe is then unchucked and rolled outside with the weld completed.

The weld is allowed to air cool to the surrounding temperature. The weld which has been made is very strong and dense, but is also brittle, and would not be desirable for oil field use. To correct this situation the heat-affected zone must be normalized.

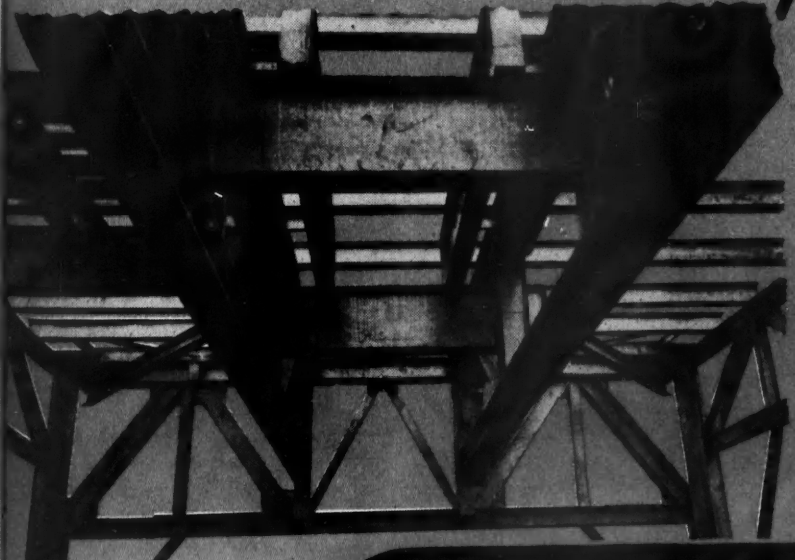
This normalizing or stress-relieving cannot be done in a conventional furnace because the entire tool joint would then be too soft for satisfactory use. Also it would be very slow and expensive, in-

A New

LEE C. Moore

TRUSS TYPE SUBSTRUCTURE

for Standard Derricks!



This new Truss Type Substructure is designed with greater capacities, sturdier welded fabrication and reduced structural weight.

Sizes are 24 ft. and 30 ft., either 4 post or 8 post, nominal heights of 10'-4" and 14'-4". Corner capacities are 1,000,000 and 1,400,000 lbs.

For increased adaptability of the standardized units the side and interior trusses, rotary beams, etc., for the two sizes are interchangeable between the 4 post and 8 post arrangements.

Any LEE C. MOORE office listed below will supply complete information.

LEE C. MOORE CORPORATION

TULSA • DALLAS • HOUSTON • MIDLAND • SHREVEPORT • WICHITA • CENTRALIA • PITTSBURGH

Export Office — 50 Church Street, New York 7, N. Y.

Figure 4 (below). Instrument section of pressure weld machine. Upset indicator and limit switch are shown at left, welding pressure gauge in the center, and oxygen and acetylene flowraters at right.

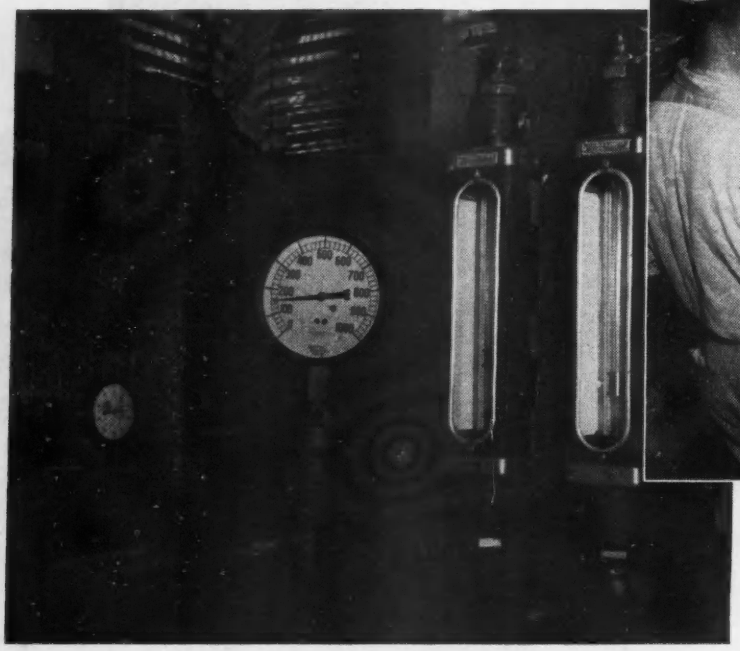


Figure 6 (above). The normalizing machine during the turning operation.

volving truck-handling of the entire joint.

To solve this problem a specially designed normalizing machine is necessary to work in conjunction with the pressure welding machine. It also can be used for stress relieving any manually applied welds on drilling tools.

The heat is supplied by three heating heads using oxygen and acetylene for fuel. These heads contain seven gas ports arranged to cover the zone desired and are water-cooled to prevent flashback. They are arranged radially, approximately 30 degrees apart, and are moved away from or toward the pipe by a single lever which is counterbalanced for easy operation. The flame from these heads is controlled by two quick-acting valves, one controlling the outer two heads, the other the inner head. The tool joint is chucked in a three-jaw manual chuck and rotated at 75 revolutions per minute perpendicular to the three heating heads.

The temperature of the heated zone is indicated by a radiant-type pyrometer. When the temperature of the welded zone has reached the normalizing temperature for the metal concerned, the torches are backed away by the operating lever so that temperature may be maintained as desired. The inner or the outer two torches may be cut off at this time to aid in maintaining temperature.

Now that the welded zone is at normalizing temperature it should be held there for a short time to insure grain and structure changes being uniform from the outside to the inside.

Figure 5. A tensile test specimen showing failure in pipe above the weld (out of the heat affected zone). Note ductile break.

The normalizing machine utilizes this time interval to turn off the external surface of the weld. A lathe compound with a flat face tool set at the desired bevel is utilized for this purpose. The cut is made while the welded zone is held at the normalizing temperature, and the torches are left on.

At the conclusion of the turning operation the temperature is checked again and an asbestos sleeve slipped over the heated zone to prevent the heated zone from cooling too rapidly. For fishing pipe this completes the process. For drill pipe the internal upset must be turned off on a hollow spindle lathe.

Technique

Now that the process and the machine have been explained the more technical problems of maintaining consistenly good welds must be considered. This is accomplished by control of materials, raw and finished; control of the welding process; and frequent inspection of the welds, internally and externally.

Raw material specifications for tool joints and drill pipe must be checked at the time of receiving the material. This is essential because change in material specifications will often necessitate a change in the welding procedure as regards the desired heat and pressure. Practically any ferrous material may be welded by this process, but the analysis is necessary to intelligently set up conditions for welding.

The drill pipe ends must be bevelled and faced smoothly. The internal and

prompt service requires *good inventories!*

BIG INVENTORIES are not enough! To give prompt service your supply store must have anticipated your needs and ordered — often many months before — the item you need NOW.

We keep big inventories; we have to in order to serve all your needs. But we take a lot of pains gearing the inventory of each store to the peculiar requirements of its territory.

That's why you get prompt, dependable service from your Norvell-Wilder man.

CALL THE *NORVELL-WILDER* MAN

NORVELL-WILDER

SUPPLY COMPANY

BEAUMONT • HOUSTON • SHREVEPORT • FT WORTH • LAKE CHARLES • CONROE • ODESSA • CORPUS CHRISTI

Figure 7. Photomicrograph of a good weld, showing no oxide, good bond, and fine grain.

Figure 8. Photomicrograph of a poor weld, showing oxide layer on welding interface.

external bevels are calculated to give the optimum upset and are essential. The face of every joint must be double checked by the inspector for squareness and lack of tool marks on the face. Tool marks on the face of the joint will cause trapped oxides in the finished weld, and oxide formation must be kept to a minimum. The bevels themselves need not be smooth, as they work to the outside during welding. The tool joint bevels and face match those of the drill pipe at their mating diameters. The faces of the tool joints should be ground to insure flatness and smoothness of face.

Control of the welding process itself is very critical but on a well-designed machine is easy to attain. This is done by maintaining the welding pressure, oxygen flow, and upset at predetermined values. No deviation from these values is desired or tolerated.

The desired conditions for welding are set up originally from experience and variations of heat, pressure and upset during experimental work. These must be juggled for every size of drill pipe until the desired weld is obtained. This is determined by quartering sample welds, nicking and breaking them in the weld. A visual examination of the break will now show how far the heat has penetrated to the interior. Other samples will be checked by a metallurgist to determine oxide inclusions and grain structure. From these analyses the next run is made under altered conditions until the desired conditions are established. These conditions are set into the machine and the welds will duplicate themselves as long as rigid control is maintained.

To augment rigid control over the welding process, constant inspection is necessary. Every weld is inspected between the welding and the normalizing machine. By visual external inspection a trained inspector can pick out welds which are not up to par by noting the characteristics of the flame pits in the welded zone. If the interior of the pipe was not up to temperature the pits will be rounded slightly instead of being sharp pits. Any dubious welds are located, of course, rejected and the machine and the operator checked carefully to determine the cause. It usually is caused by attempting to adjust the flame by eye instead of using the flowrater, or by incorrect setting of the upset limit switch mechanism.

Sample welds from production runs are pulled at random and destructive testing performed in addition to the continuous visual inspection. Some of these welds are tensile tested for yield point and ultimate tensile strength. Other samples are nick tested, bend tested, and metallurgical reports rendered on grain structure and oxide content.

The nick test is the simplest test and actually one of the most informative. The welded zone is quartered and a saw cut made on each side into the weld on one of the sections. It is then placed on its side on an anvil or in a vise and sharp blows struck to cause fracture in the welded zone. Visual inspection of the weld will then determine the depth of penetration of the welded zone toward the interior of the pipe. The percentage of weld is recorded. Due to the upset created by the welding, this percentage can be as low as 70 percent and still be stronger than the pipe itself.

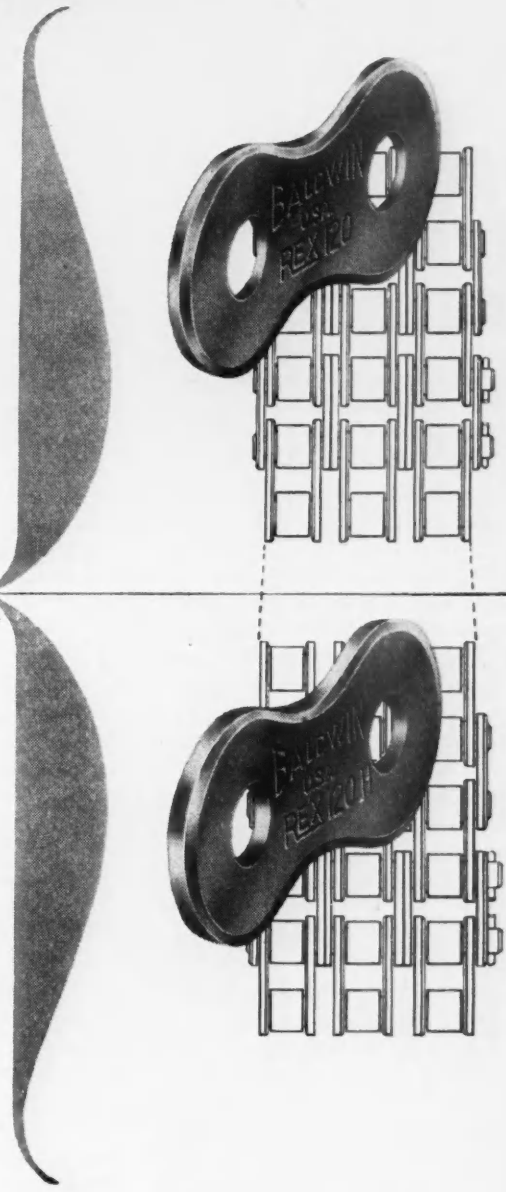
The bend test is a back bend on a quartered sample. This is used to give an indication of the ductility of the welded zone. Unless the welded zone is ductile it may fail in fatigue or torsion, though a tensile test may show it to be stronger than the drill pipe.

The metallurgical report is based on a microphotograph of a nital etched section through the weld. Oxides, if present, will show up here. Also, the grain structure and the bond on the weld interface are shown. A hardness survey is made through the heat affected zone for the purpose of checking the normaling and to insure that no hard spots remain to cause fatigue failures.

It appears obvious from this brief discussion of pressure welding that it has unlimited possibilities in the manufacture of oil field tools and accessories. In any case where changes of section occur that make machining difficult and expensive, along with attendant waste of material, pressure welding is a possible solution to the problem. To be balanced against it of course must be considered the initial expense of the machine and the requirements of different heating heads and chuck jaws for each application. Where production will justify the original expense it may well be the answer to many a manufacturing problem.

do you know Roller Chain...

is made in standard and extra heavy series?



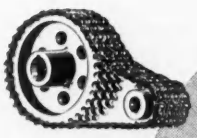
And that's an important fact to know when you need a replacement roller chain.

The two series, although generally similar in appearance, are not interchangeable where multiple strands are being replaced. The *Extra Heavy* series has thicker side bars and will not fit the same sprockets used with *Standard* series. In addition, the added width of the *Extra Heavy* series frequently cannot be accommodated in a drive except with single width chains where a *Standard* series chain is now being used.

Check the chain number listed on the side bar of your present roller chain carefully before ordering replacements. *Heavy* Series are indicated by the letter "H" on the side bar after the chain number . . . for example, 120H.

You'll get a new high in service . . . a new low in maintenance by replacing with Baldwin-Rex Standard or Extra Heavy Series Roller Chains. They are interchangeable with any corresponding size roller chain.

Baldwin-Rex Roller Chains are for sale in all oil fields. For information, see your Baldwin-Rex Field Engineer, your local supply store or write us direct.



BALDWIN·REX
ROLLER CHAINS

BALDWIN-DUCKWORTH DIVISION OF CHAIN BELT COMPANY

341 Plainfield Street, Springfield 2, Mass.

SPECIAL TRAILER SPEEDS

By ELTON STERRETT
Engineering Editor

A WIDE, flat-bed trailer, mounted on a pair of crawler treads, solves the problem of location switch of a derrick for relatively shallow drilling. Stripped only of crown block and drawworks, the derrick is lifted and centered by the trailer, and towed to the new site by the same tractor which spots the hauling unit below the specially constructed derrick floor section.

SKIDDING the derrick from a completed well to a new location is, theoretically, the method which requires least down time and which costs least. Where terrain and spacing rules permitted, derricks have been jacked up onto special structures which, in turn, have been "towed" considerable distances by anchored winch trucks, crawler-type tractors and even, in a few instances, by their own power through a line to the drawworks.

In the relatively shallow drilling which characterizes the production on its sulfur dome, The Texas Gulf Surphur Company has developed a method of derrick shifting which eliminates the tedious jacking operation, and which in many cases has resulted in the beginning of making new hole within two hours of the time the rig "signed off" on a previous well.

Three parts of the equipment contribute to the success of the method evolved: the trailer; the derrick base; and the foundation pads or shoes.

The trailer is an ingenious combination of crawler tread, lever, and hauling platform. A pair of crawler treads, of the type used by the artillery for moving heavy armament, is equipped with a special trunnion bed to which is pivoted the wide bed which supports the derrick when on the move. The bed bearing point is midway between the axles of the crawler, to assure maximum stability wherever the unit may be placed. The front end of the trailer is supported by a pair of wheels with fifth wheel and tongue for towing. The wheels carry only a small portion of the load, serving to guide the unit and insure its tracking behind the tractor when being shifted.

The trailer bed is equipped with parallel side rails, welded to the edge of the flat steel plate and elevated above it sufficiently to provide clearance and concentrate the bearing load on the rails.

The derrick base is a rigidly built structure formed by welding up pipe trusses to form a latticework two feet thick, above which is welded the steel floor. On the base of this structure, on the side opposite the overhang which supports the drawworks, are welded two runners or guides, which are spaced to fit closely outside the two rails of the trailer. The four corner posts are hollow, and extend above the floor level to permit attachment of the legs of the derrick. The posts also extend downward below the lower edge of the skid rails, terminating in a broad flange.

Inside these corner posts slide the center spuds of the foundation pads. These are heavy steel plate, with the edges turned upward to act as skid shoes in case the pad touches ground on the move. Pins, working through matching holes in the corner posts and the pad spuds, allow the distance between derrick floor and pad to be adjusted over a considerable spread, so as to permit levelling of the floor on sloping or uneven terrain. The combined weight of the floor section and pads is 14,000 pounds. The 87-foot derrick mounted thereon weighs 10,000 pounds, stripped for moving.

Picking Up the Load

When a derrick is to be moved, the winch line from the tractor is carried back under the floor midway between the two guide rails, and attached to one of the cross members of the unit. The line is then brought out and carried across the bed of the trailer, and over the roller at the front end. The trailer is backed until the rear edge contacts the front of the derrick. Then, by winding in on the winch line, the rear end of the trailer is pulled down until it has passed below the lower edge of the base unit. Continued winching pulls the trailer back under the derrick, the sloping bed serving as a moving wedge to lift the forward portion of the floor section. When the trailer has been carried past the center of the derrick the winch is stopped, the tractor started forward slowly, and the derrick rights itself to distribute the load partially on the leading wheels, the remainder resting solidly on the crawler section of the unit.

The tow to the next site is made rapidly, without guying the derrick or clamping it to the bed of the trailer. In case the uneven surface causes the derrick to tilt, the corner pad will strike the ground and resist overturning before a perpendicular from the center of gravity of the unit has passed outside the area of the bed of the trailer.

The derrick is unloaded from the trailer at the new site by carrying the winch line over the trailer and back to the leading edge of the floor section. Pull on the line will then tend to slide the derrick back off the trailer, or move the trailer forward under its load. This motion continues until the rearward pair of pads or feet contact the ground, when the tilt of the bed will continue, under the restraint of the winch line, until the forward edge has been lowered slowly to the ground with the bed of the trailer acting as a lever to control the rate of descent.

The two pads at the rear of the derrick are adjusted to the desired point by releasing the locking pins as the pads touch ground, and allowing the tilt of the derrick to force the spuds within the pipe to the desired depth. The pins then are replaced, and the desired length of support thus attained.

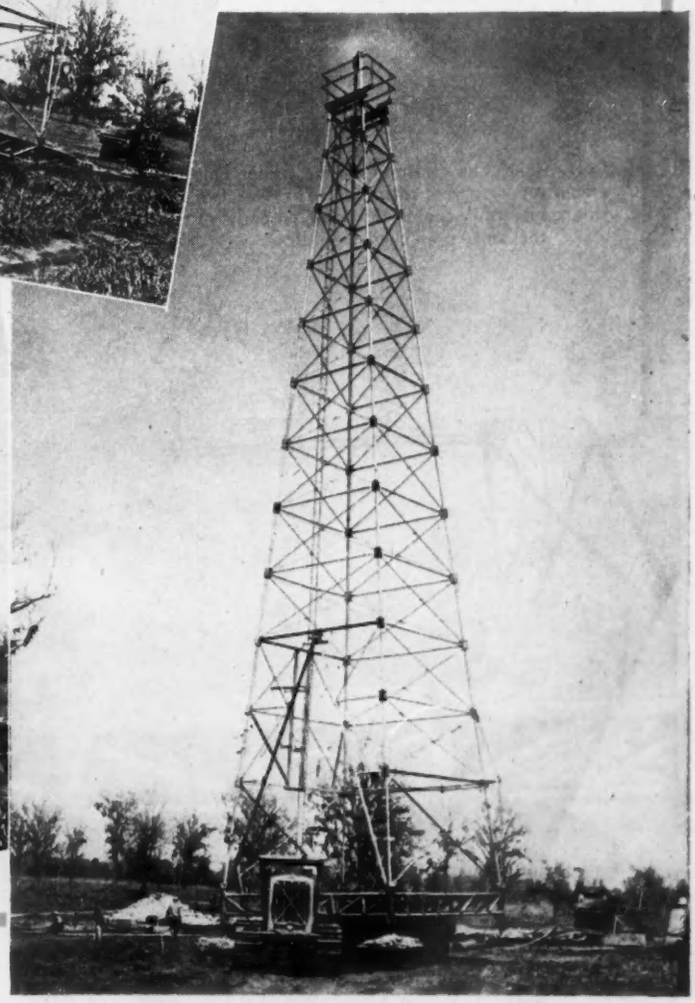
The derrick floor contains a cellar opening in its center, and a wide overhang on which the drawworks is skidded from the truck used to move that unit. The adjustable legs are so set that the height of the derrick floor will permit a direct skid of drawworks from truck bed to overhang.

DERRICK MOVES

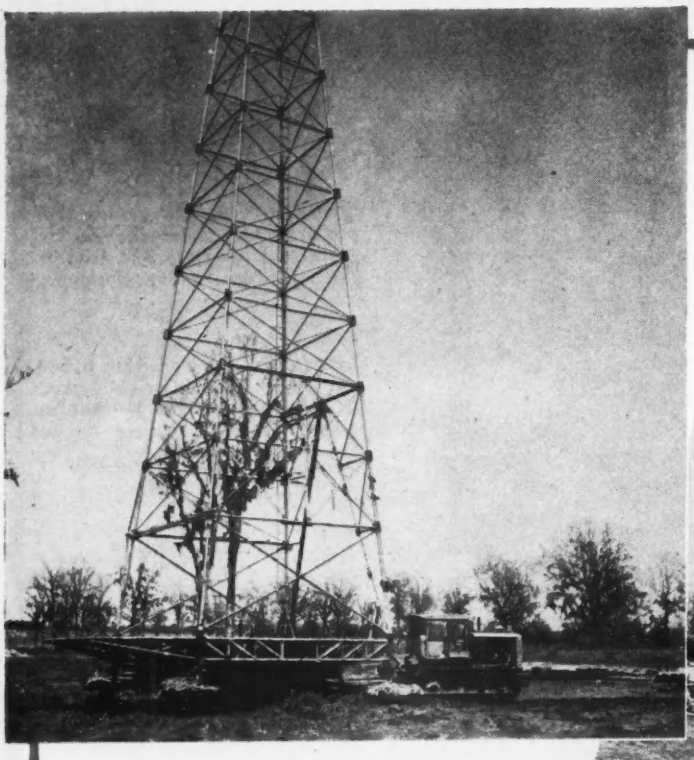
Left. The trailer, in position for being backed under the derrick to lift the structure and load it on the broad hauling platform.

Left Center. The trailer has tipped the derrick, and is being worked into carrying position by pull on winch line and backward motion of tractor.

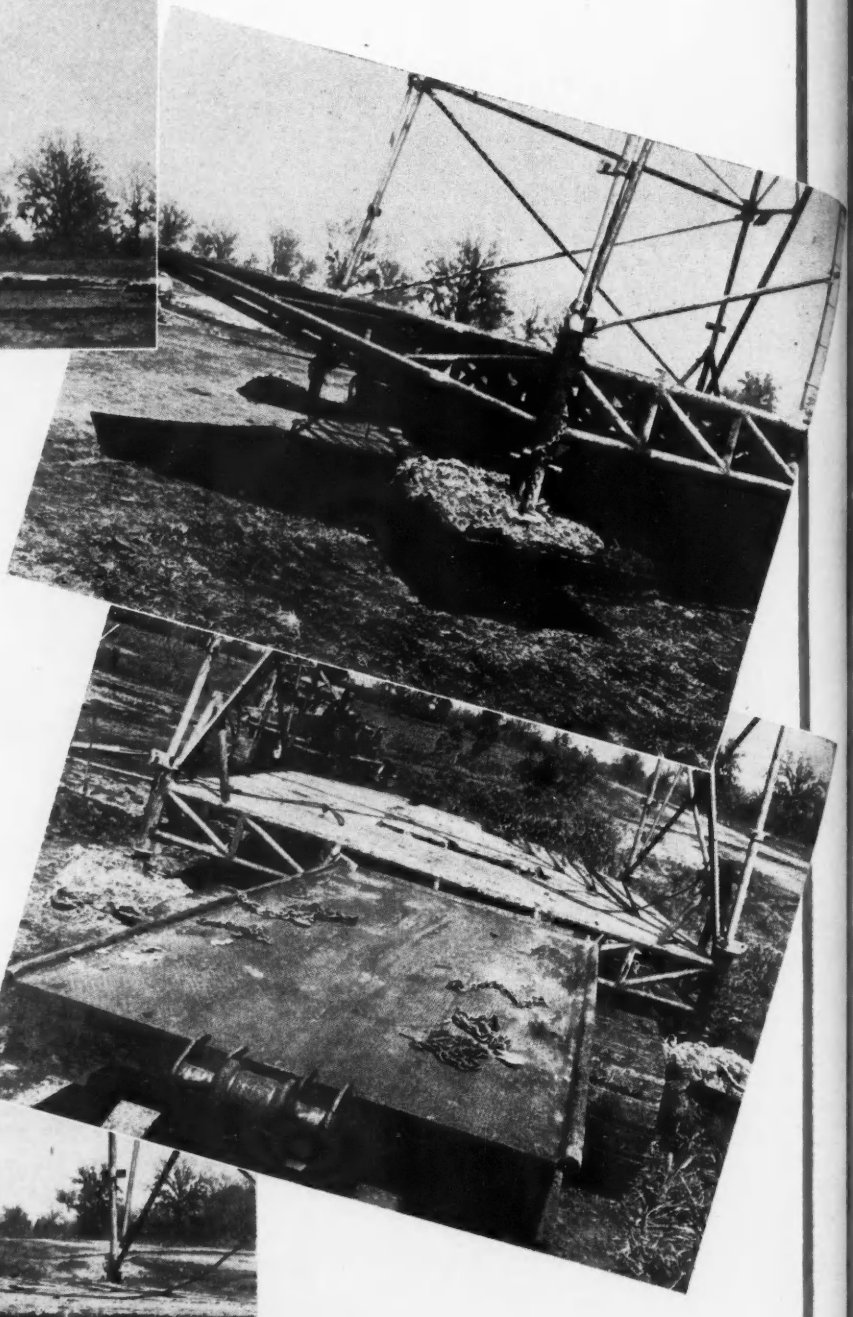
Left, below. The trailer is positioned below the center of the derrick, and is ready to be tipped forward to bring some of the weight on the pair of wheels at the front of the unit.



Below, right. The derrick balanced on the platform, without assistance of guy lines, the tractor moves off to the new location. The foundation pads act as fenders to prevent excessive tilt of structure on rough going.

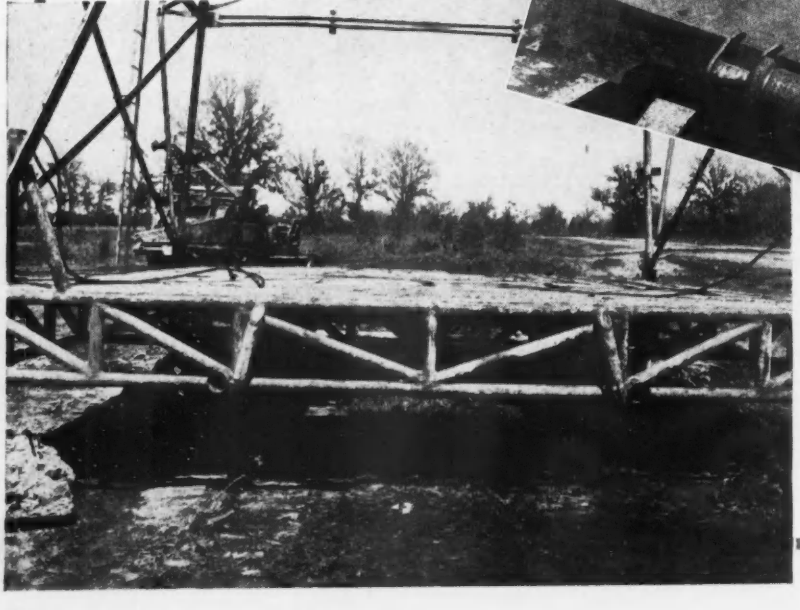


Left. Arrived at the new site, the trailer is backed into the desired position. Winching the carrying unit out from the derrick tilts it backward so that the rearward pads come to rest first, the trailer serving as lever to lower the front edge gradually.



Upper right. The cantilever section which carries the drawworks. The method of attaching and adjusting the foundation pad is readily apparent.

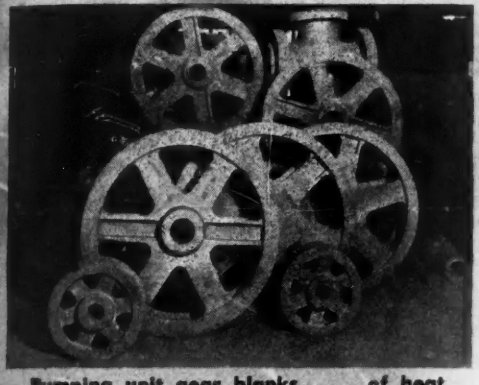
Lower right. The platform on the trailer unit which supports the entire derrick. The two pipe guide rails center the load properly as the unit is winched into place.



Left. Two guide rails, welded below the sturdy truss of the derrick floor structure, insure proper location of the trailer as it is winched into place for the move and insure proper alignment during the lowering operation.

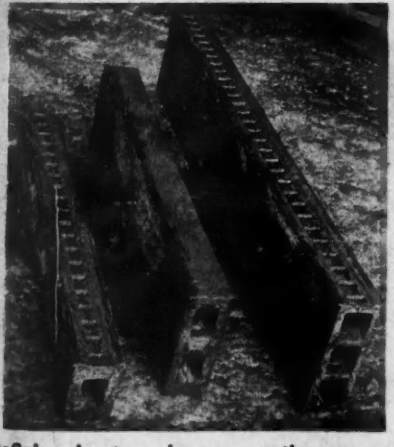
Bits . . . tough and strong for longer service life

Fluid end of mud pump . . . an intricate high pressure casting

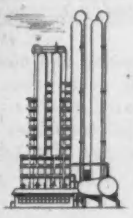


Pumping unit gear blanks . . . of heat treated alloy steel

High pressure well head castings . . . insure safe control



Refining heat exchanger castings sound and true to pattern



TESCO STEEL CASTINGS

from beginning to end

Dependable equipment in every phase of the oil industry . . . drilling, production, refining and natural gasoline . . . is made stronger and safer by *quality* TESCO Electric Steel Castings. The TESCO Hallmark has been recognized as a sign of genuine quality on dependable equipment in the oil industry for more than 20 years. Present expanded facilities at TESCO were designed to help you solve your equipment casting problems . . . however small, large or intricate. Extensive physical and chemical tests control every TESCO Casting. Write or call the TESCO Representative. We also have complete heat treating and stress relieving facilities available to fabricators and refineries.

TEXAS ELECTRIC STEEL CASTING CO.

GOOD CASTINGS — TESCO (CARBON AND ALLOY STEEL) — HOUSTON, TEXAS

NEW INDENTATION METHOD DETERMINES EQUIPMENT WEAR

DETERMINATION of wear on cylindrical or other curved wearing surfaces has been done only with difficulty under conditions imposed by measuring devices available. Where parts are relatively small and can be detached without too much dismantling, the method of weighing accurately before and after wear has been applied. This gives a close estimation of the amount of metal abraded during the service period, but provides no means of apportioning or distributing the decrease in weight in terms of metal from any given area.

Where the parts are cylindrical, such as internal combustion engine pistons, tool joints, or sheaves, the difference in diameters before being put in service and when pulled for inspection can be learned through calipering or micrometering. But the difference in diameters at any given pair of points on the circumference cannot define the amount which the part has become out of round. Tool joints, for example, rarely wear evenly all around. Most cases of serious abrasion are found to occur over not to exceed 120 degrees of the circumference, while the worn area in cases where the drill string is known to be whipping badly show less than a quadrant of the circle to have been reduced. Diametrical calipering of such a section would, if the normal procedure were followed of dividing the loss in diameter by two, give a radial decrease which would be far below the actual value, and corrective measures—such as hard-facing—applied over a surface after such determination of the amount of wear would result in a reconditioned piece out of axial balance. In extreme instances this out-of-balance condition might be serious enough to bring about overstressing of the drill string and resultant twist offs or pipe failure.

Third Method

On internal combustion engines, especially those with closed lubrication systems, a third method of approximating wear has utilized a careful separation of metallic particles from the lubricating oil, and quantitative determination of the types of metal thus obtained.

Even under ideal conditions, none of the methods outlined has been without serious limitations; and, when coupled with field or normal shop handling, readings often were so far from the mark as to be useless if not misleading. Such limitations, coupled with the fact that the methods often indicated other conditions along with wear, stressed the desirability of developing a method for wear determination which would be independent of the size or mass of the wearing piece.

Investigations conducted at the National Bureau of Standards under S. A. McKee led to the adaptation of a diamond indentation method of measuring wear. As a result a sensitive measuring instrument, the McKee Wear Gauge[3], was developed to measure extremely small increments of wear, as little as 1:100,000 inch under favorable conditions—considerably less than possible with other methods. By applying to the working surfaces narrow diamond-shaped markings which show a definite change in one or more readily measurable dimensions after relatively small amounts of wear, the gauge provides a determinable indication of wear at the point where the marking is made.

Extensive tests at the Bureau have provided conclusive evidence that the indentation method of determining wear overcomes the shortcomings of other methods. For example, the weighing method gives a value for the total wear but does not indicate where the wear occurred. Measuring the changes in the dimensions of a worn piece has this same limitation to a lesser degree and

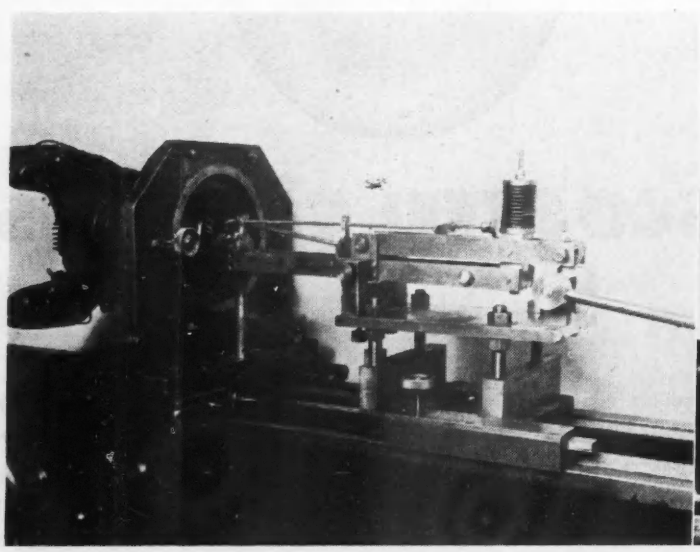


Figure 1. Apparatus developed at the National Bureau of Standards utilizing a diamond indentation method of measuring extremely small increments of wear—as little as ±0.00004 inch. An aircraft engine cylinder is shown mounted in a special fixture with the gauge in position to make a mark on the cylinder surface. The indentation, applied to any desired position on the surface, is of such shape that a relatively small amount of wear will make a definite change in one or more measurable dimensions of the mark. This provides a very accurate indication of wear at the point of the mark.

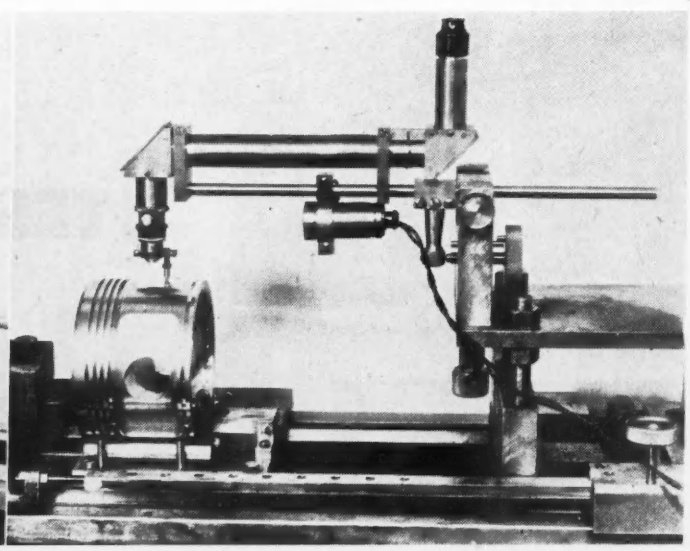


Figure 2. The viewing and measuring apparatus used in conjunction with the McKee wear gauge consists of a microscope and eye-piece scale modified to be used as a periscope for viewing the inside of a cylinder. In this setup the apparatus is being used to view and measure the changes in dimension of a mark placed on a piston surface in order to determine the amount of wear.

OVER . . .

IT'S Wilson

DOING A BETTER DRILLING JOB IN MORE THAN 26 COUNTRIES

Here's proof of the superiority of the Wilson Rig . . . it can be found in every active oil field . . . the world over! We are not surprised at their outstanding popularity, for Wilson Rigs have been engineered to do a better job. They are easy to operate . . . easy to repair . . . plenty of power and speed in coming out of the hole . . . enough power to drill in any formation and to any depth . . . and made to withstand the most gruelling treatment.

From shallow wells to the "yet-to-be-reached" depth of 21,600 feet there's a Wilson Model that will do a better drilling job for you. Be sure to investigate the Wilson line of stream-lined power-rigs . . . now!

The new Wilson Catalog 168 showing new models, improvements and new devices on the Wilson Rigs and Winches. Send for your free copy today!

EXPORT REPRESENTATIVE • GUY E. DANIELS • 30 ROCKEFELLER PLAZA • NEW YORK CITY
PACIFIC COAST DISTRIBUTOR • POWER RIG & EQUIPMENT CO. • LOS ANGELES, CALIFORNIA

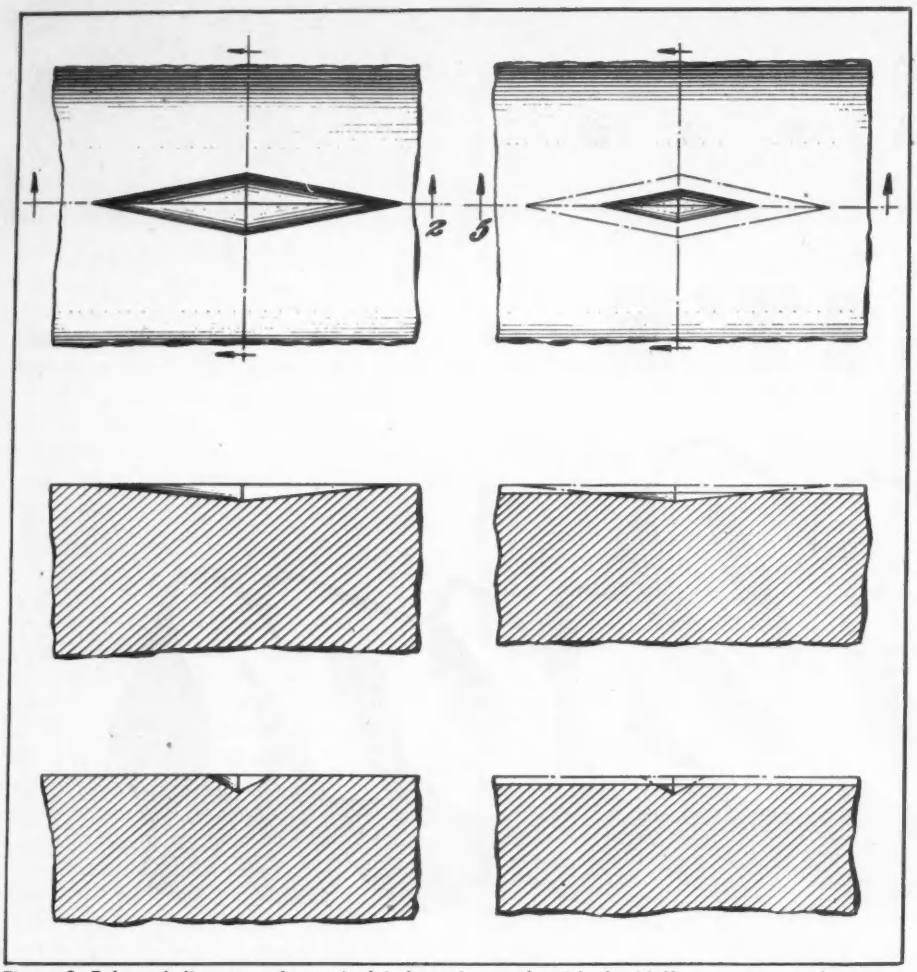


Figure 3. Enlarged diagrams of a typical indentation made with the McKee wear gauge by pressing into the wearing surface the apex of a four-sided diamond pyramid having a rhombus-shaped base. Views on the left (top to bottom) are the plan, longitudinal, and transverse sections of a mark before wear has occurred, while those on the right are the same mark after material has been worn from the surface. It will be noted that the shape of the mark remains the same, but the length decreases in proportion to the thickness of material removed. For the diamond used, the ratio of depth of mark to length of long axis is about 1 to 35, that is, a mark about 0.001 inch deep has a long axis of about 0.035 inch.

does not differentiate between actual wear and other changes that may occur such as growth, shrinkage, or distortion of the part. The method of determining the amount of worn material in the lubricant presents a number of difficulties and usually is used only as a qualitative indication in conjunction with other data.

The McKee gauge was designed primarily to locate and measure indentation marks on the cylinder walls and pistons of radial aircraft engines, since permanent distortion of such parts during operation had heretofore nullified the significance of any previous methods of measurement. The choice of the type of mark was influenced by an earlier development at the National Bureau of Standards — the Knoop Indenter for measuring the hardness of materials.

Special apparatus was developed for making and measuring the marks placed on the wearing surfaces by the diamond indenter of the wear gauge. With a cylinder or piston mounted in a specially designed fixture, marks are applied at any desired position on the surface by means of the diamond point, which is forced by mechanical pressure to a predetermined depth into the surface piece. The viewing and measuring apparatus consists of a conventional microscope and eye-piece scale, modified by the addition of two right angle prisms so that it may be used as a periscope for viewing the inside of the cylinders.

The impression of the marks in the surface of the metal raises a burr around the mark. The shape of the diamond indenter is such, however, that the major portion of the burr is formed on the sides of the mark. Though no burr is visible to the eye at the ends of the marks, the presence of a very slight elevation of the surface may account for the minor deviations from a straight line shown by calibration curves. In the course of the investigation it was found that most of the burr could be easily removed by rubbing lightly with fine polishing paper. For use with the cylinders, a sheet-metal guard similar to the usual erasing shield but of larger dimensions was found convenient. The holes in this guard are so arranged that the polishing paper can be rubbed over a small area at each mark on the cylinder wall with one finger.

As the marks are placed with their long axes perpendicular to the axis of the cylinder, the relation between the change in depth of mark to change in length of long axis is affected by the curvature of the cylinder. While this effect is relatively small for the particular cylinders used, suitable corrections for curvature provide greater accuracy in determining wear.

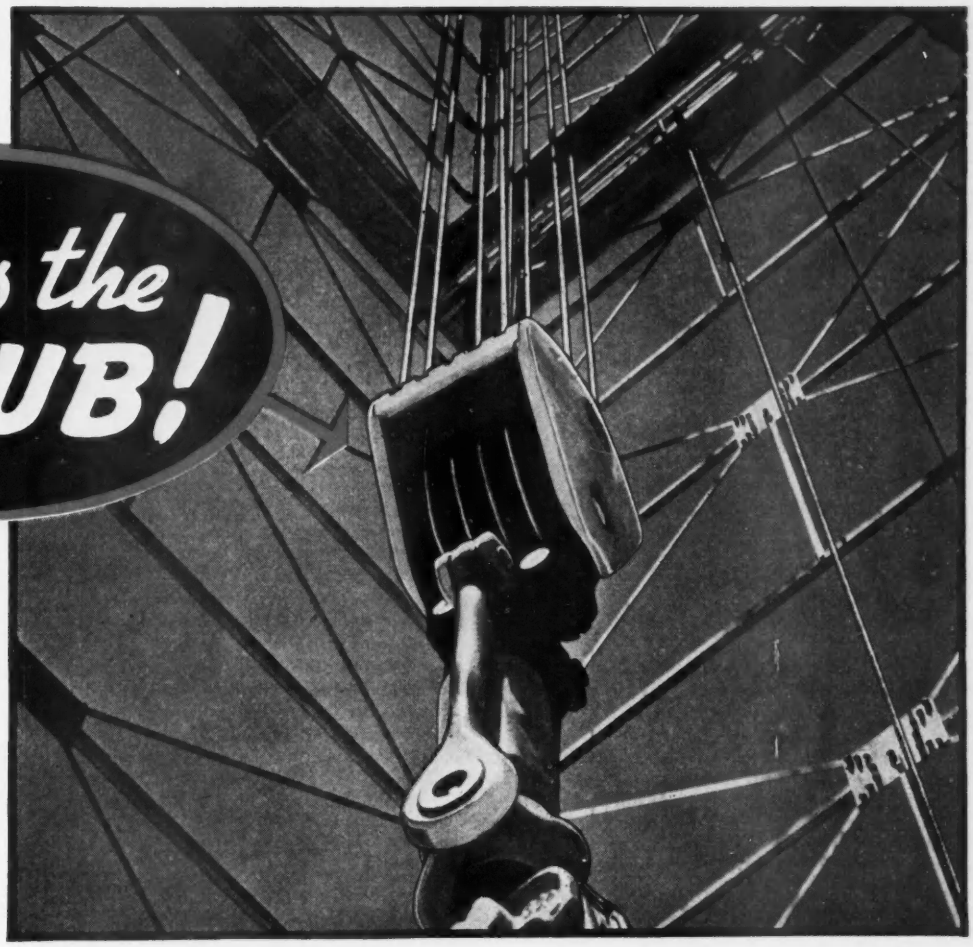
A study also was made of the possibility of error due to the axis of the diamond indenter not being at right angles to the surface when the indentation is made. Computations indicated that if the diamond-shaped mark was symmetrical to within a ratio of not less than 41 to 50 along its major axis, the error would be no greater than 1 percent (approximately 0.00001 inch). It was found that the apparatus could be adjusted to produce a symmetrical mark and that other marks, either in the same cylinder or in other cylinders of the same nominal size, could be made well within the limits of symmetry without further adjustment. Accordingly, corrections for lack of symmetry were not necessary.

Shape Retained

One of the important considerations in the Bureau's investigation was uncertainty as to whether the marks would return to their shape during operation of the engine. Results of a number of engine tests have shown that marks in the cylinders of radial aircraft engines retain their shape sufficiently to provide reasonably accurate wear measurements. Experience has indicated that results are not as satisfactory after the marks have been worn to about one-fourth of their original length or less. Hence, greater accuracy may be obtained by carefully regulating the size of the mark and adjusting the duration of the test to prevent this condition.

The precision of the wear measurements depends upon the condition of the indentation. With new marks the points are sharp and the lengths can be accurately determined. However, after the engine has been operated the marks are somewhat blunted and it is necessary to estimate the position of the point (Figs. 3 and 4). Under normal conditions the cylinder wear can be determined with an overall accuracy of ± 0.00004 inch. For more favorable conditions the degree of accuracy can be increased to ± 0.00002 inch. Operating experience with marks in the pistons indicates that, with the softer aluminum alloy, the marks have a much greater tendency to distort and the results are not entirely satisfactory. Another difficulty with this

There's the RUB!



...and wherever wire rope works over sheaves—and on drums—there are also bending stresses. Heavy loads, too, add their burden.

You can depend on "Hercules" (Red-Strand) Wire Rope to meet all conditions, because it is the right combination and balance of strength, toughness and durability. As it is made in Round Strand and Flattened Strand constructions—both Preformed and Non-Preformed—there is a correct type for every heavy duty purpose.

Let the Red-Strand be your wire rope guide to faster and more economical production. We invite your inquiries.

"HERCULES"

REG. U.S. PAT. OFF.

RED-STRAND

WIRE ROPE

MADE ONLY BY

A. LESCHEN & SONS ROPE CO.

ESTABLISHED 1857

5909 KENNERLY AVENUE • ST. LOUIS 12, MISSOURI

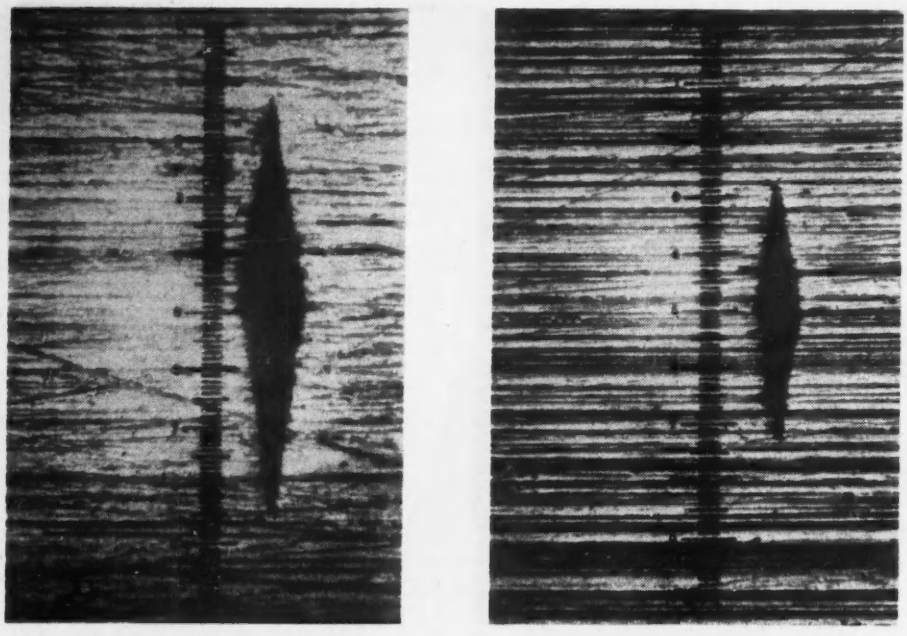


Figure 4. Photograph (after engine operation) of two typical marks used for determining extremely small increments of cylinder wear by the diamond indentation method developed at the National Bureau of Standards. These marks were originally about 0.9 millimeter long. The scales shown represent an actual length of 1 millimeter (0.0394 in.) but when observed in the viewing apparatus are 2½ inches long. For the diamond used and chrome-molybdenum steel cylinders the total length of the scale represents about 0.0012 inch in depth, hence one of the small scale divisions is equivalent to slightly more than 0.0001 inch of wear. This gives an idea as to the order of sensitivity of the method.

material is its tendency to become impregnated with carbon making it difficult to distinguish the marks.

Most of the engine tests for determining the performance of the marks in service were made with engines having chrome-molybdenum steel cylinder barrels 5 3/16 inches in diameter. In these tests 24 marks were made in each cylinder, six spaced 60 degrees apart at each of four levels—approximately 2, 4, 6 and 8 inches from the open skirt end of the cylinder. The upper row of marks was in contact with the top ring only while the lower was contacted by the oil ring. Typical cylinder wear patterns obtained in these tests reveal unsymmetrical wear with respect to the axis of the cylinder that would be impossible to determine with usual measurements of diameter.

Employing the basic principles of the original McKee gauge, an instrument was designed for use with automobile engines in which the cylinders are cast into a single engine block. This instrument, used in an extensive series of tests by C. S. Bruce, J. T. Duck, and A. R. Pierce of the Bureau's Automotive Section, permitted accurate studies of the effects of wear in stock passenger-car engines operated under controlled conditions. The test engines were operated for 144 hours (approximately 3000 miles of normal operation) between wear measurements, the operating cycle consisting of 20 minutes of actual operation with a ten-minute stop for cooling. During the stop period a special cooling system reduced the temperature so that the engine was started from a cold condition at the beginning of each half-hour period.

Results of these tests, in which the average cylinder wear was about 0.00002 inch per 1000 miles of operation, verify a previously accepted theory that operating conditions have a decided effect on cylinder wear, there being in general a greater amount of wear when starting the engine at low temperature than at high temperature (122° F.). The data provided by such sensitive determinations of wear also indicated the possibility that corrosion is responsible for a major part of the wear occurring in nomal operation of an engine. It is believed that moisture condensing on cold cylinder walls serves as a base for the formation of corrosive acids from the gases in the products of combustion. It appears that engine life may be substantially increased by any feature of design that accelerates the engine warmup or prevents the temperature of the cylinder walls from falling below the dewpoint of the exhaust gases. Additional data on the corrosive qualities of fuels would be desirable.

The indentations used in the studies at the Bureau were made by impressing into the test surface the apex of a four-sided diamond pyramid. From the standpoint of accuracy the chief limitation is that the sharp points of the marks are blunted somewhat when wear occurs. Possible use of cutting or grinding methods for producing marks without burrs and without sharp-pointed ends presents a promising field for further investigation. If this can be accomplished, the accuracy of determining wear would be greatly increased.

The McKee gauge provides the particular advantage of an indication of wear only, while the usual measurements of changes in diameters of the pistons and cylinders do not differentiate between wear and distortion that may occur during a test. It also indicates wear at a particular point on the surface, whereas measurements of diameter involve changes at two points and practical means are not generally available for determining the amount of wear at each point. Also, the method does not require the careful technique necessary to measure diameters with corresponding accuracy.

As temperature variations do not materially affect the accuracy with the indentation method, it is not necessary to bring the cylinder to a definite temperature before making the measurements. The apparatus is provided with locating pins and is so arranged that a mark made at given pin settings will fall within the field of vision of the periscope at the same settings. This eliminates loss of time in searching for the marks which are too small to be readily discernible to the eye.

In addition to its use as a practical method of measurement of wear in aircraft and automotive engine cylinders, the indentation principle appears applicable to other machine elements, gauges, dies, and wearing surfaces where the material is of such a nature that the indented marks will retain their shape in service. For example, a mark placed on the wearing surface of certain production dies would readily indicate when it had been worn beyond specified tolerances.

REFERENCE

[1] Developed at the National Bureau of Standards by S. A. McKee at the suggestion of and with collaboration of Dr. H. C. Dickinson. The method is covered by U. S. Patent No. 2,333,403, granted to Dickinson and McKee and assigned by them to the U. S. Government.

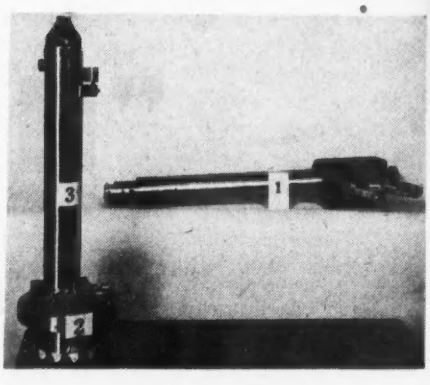
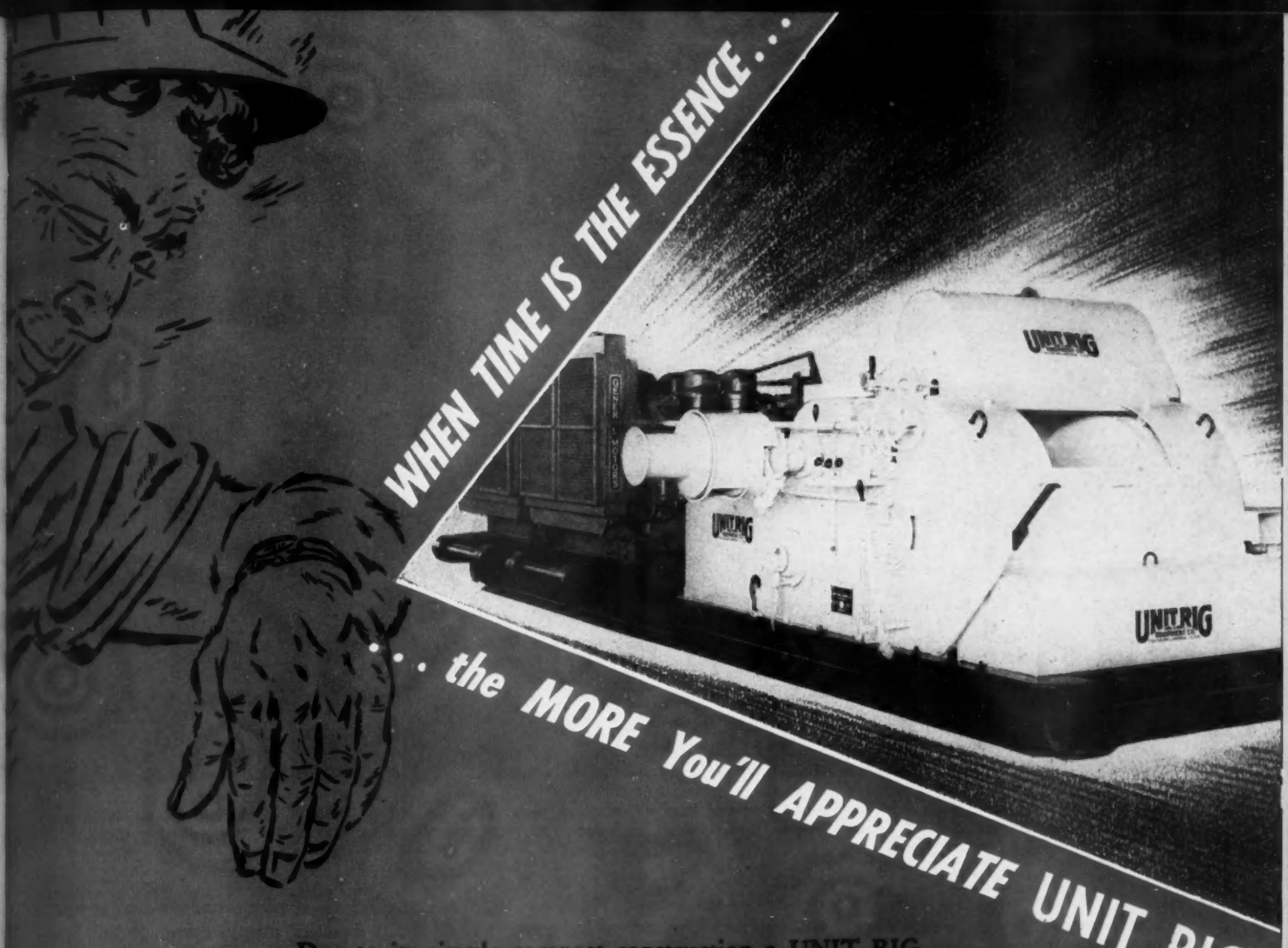


Figure 5. The McKee Wear Gauge as designed for use with automobile engines in which the cylinders are cast into a single engine block. The three components of the instrument are: 1. Indenting tool, 2. Indentation locator, and 3. Microscope.



Due to its simple compact construction a UNIT RIG can very quickly be transported to its new location, and put to work in "nothing flat" . . .
Steady, Dependable performance assures best possible drilling time and a minimum of shut-down.

See a UNIT RIG in action, or ask the man who runs one — before you buy drilling or well-servicing equipment.

UNIT RIG & EQUIPMENT CO.
TULSA, OKLAHOMA U.S.A.

DESIGNED FOR THE JOB

Exclusive Export Representative
MID-CONTINENT SUPPLY CO.
42 Broadway, New York City
Cable Address: MIDUNITRIG

BOATS SERVE AS MUD PITS FOR WORKOVER RIG

By H. M. PEARCE

Two boats form the mud pits, being connected with a rubber hose at adjacent ends. They are set up parallel to the derrick so as to use standardized pipe connections and do not require special bases or supports on most soils. Blocking is needed if the ground is rocky.

RARELY are the original mud pits still available when a well requires a workover job, in which case only a dike to reduce the area of the pits is needed. In many fields, however, the cost of providing pits becomes a large fraction of the entire workover cost, and digging the pits and laying out mud lines require as many days for the crew as the actual down-the-hole operation.

Steel tanks are used as pits by many operators to provide the mud supply, but such tanks are heavy, hard to move, and require the securing of considerable steel plate. This latter is in great demand for other operations, and much delay is met in obtaining deliveries.

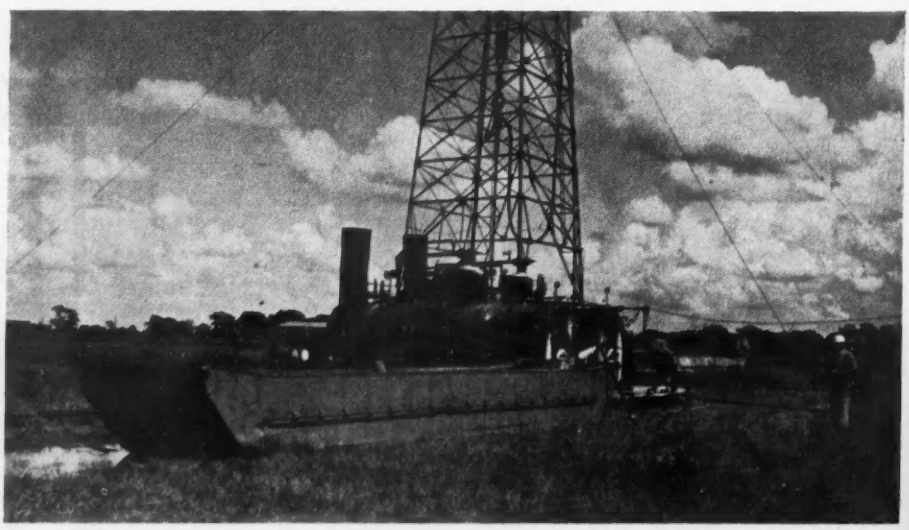
One drilling contractor solves the mud-pit problem through ingenious use of surplus war equipment. He bought up a number of the pontoons used by the Corps of Engineers for bridge construction and converted them to tanks with very little changeover. The bulkheads which give stiffness to the sides of the boats were cut out with a torch at their lower edge to give wider passages for mud flow. Three flange connections were welded into the sides of the two boats for mud, while the fresh-water boat was left unchanged, except for bulkhead swash holes, which were fitted with screens.

Flanges welded to the adjacent sides of two pontoons with a six-foot hose connection between allowed mud to flow from the first tank into the corresponding end of the second. Flow was for the full length of the second boat, where the other hose connection was set into the end. The outlet was placed about three-fifths of the way up from the flat bottom of the boat, to allow for settlement of any cuttings which might be in the stream.

The relatively high setting of the suction outlet gave a slight gravity head into the suction hoses of the pair of mud pumps. A section of hose absorbs vibration and settling stress and protects the fitting welded to the end of the boat.

The return stream from the casing normally empties into one end of the first boat, with a shale shaker mounted across the thwarts if sufficient hole is to be made to require separation above that obtained by circulation through the system. When drilling cement, the shaker or normal flow connection is removed and sufficient pipe attached to carry the stream to the designated site for wasting it.

The hopper for the mud additives is mounted at one end of the first boat, the pipe supplying mud to operate it being



On dry land, this surplus Army boat is "turned wrong side out" by being used to contain water instead of to hold it out. It is the fresh water supply "tank" for the boilers and for drilling cement plug with this workover rig.

Rods Provide . . .

long economical service

Your pumping profits start with National Sucker Rod Steel. It is constantly checked in our Chemical and Metallurgical Laboratories to maintain precise specification that will give you a string of uniform strength.

The economy of long service is built into National Sucker Rods by skilled workmen employing special machine tools and manufacturing processes. A rigid inspection maintains the highest possible standards of quality.

The inherent quality of National Sucker Rods is armored against premature corrosion by a baked on protective coating.

Your pumping problems can be solved quickly and profitably by selecting from conveniently located stocks, the National Sucker Rod that answers your requirements. Call the National Store in your locality for immediate attention and service.

NATIONAL UNIT PUMPERS

You will earn even greater pumping profits when you connect a string of National Sucker Rods to a National Unit Pumper. There are twelve basic sizes which are adaptable to thirty-seven standard combinations — the most complete combination of specifications available to the industry.

THE NATIONAL SUPPLY COMPANY

GENERAL SALES OFFICES: TOLEDO, OHIO · DIVISION OFFICES: CASPER · FT. WORTH
PITTSBURGH · TULSA · TORRANCE · EXPORT: NATIONAL SUPPLY EXPORT CORPORATION,
30 ROCKEFELLER PLAZA, NEW YORK, N. Y., U.S.A. · RIVER PLATE HOUSE, 12 SOUTH PLACE, LONDON, E. C. 2

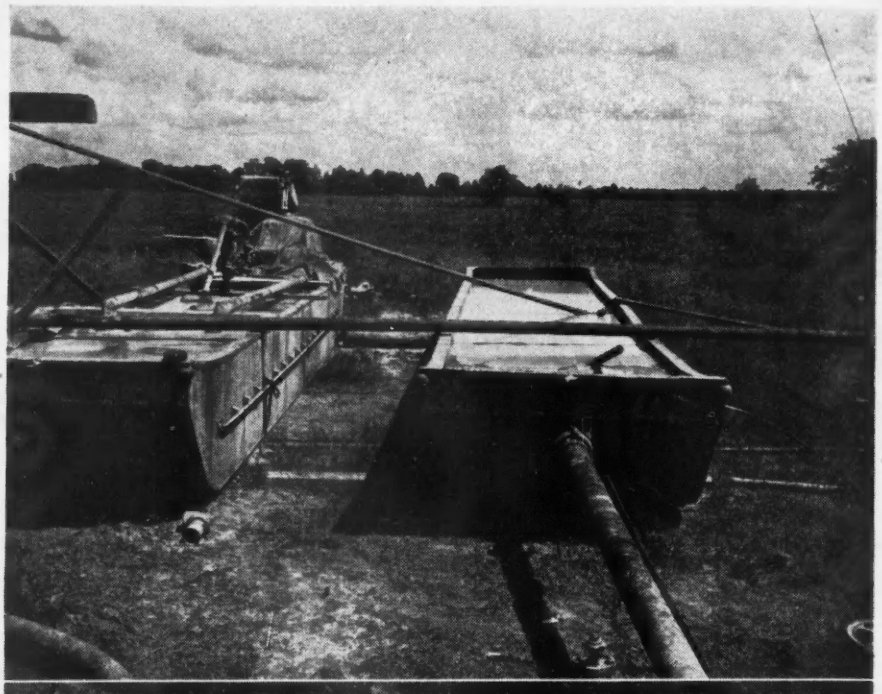
carried along the side of the boat. This same line furnishes high-pressure mud to the jetting gun, carried on a pipe between the thwarts. The gun is swivelled, so it may be used to unblock the suction hose connecting the two boats, as well as to stir the body of material in the boat at the point where the returns empty. The jet also reaches to the point of discharge from the hopper line.

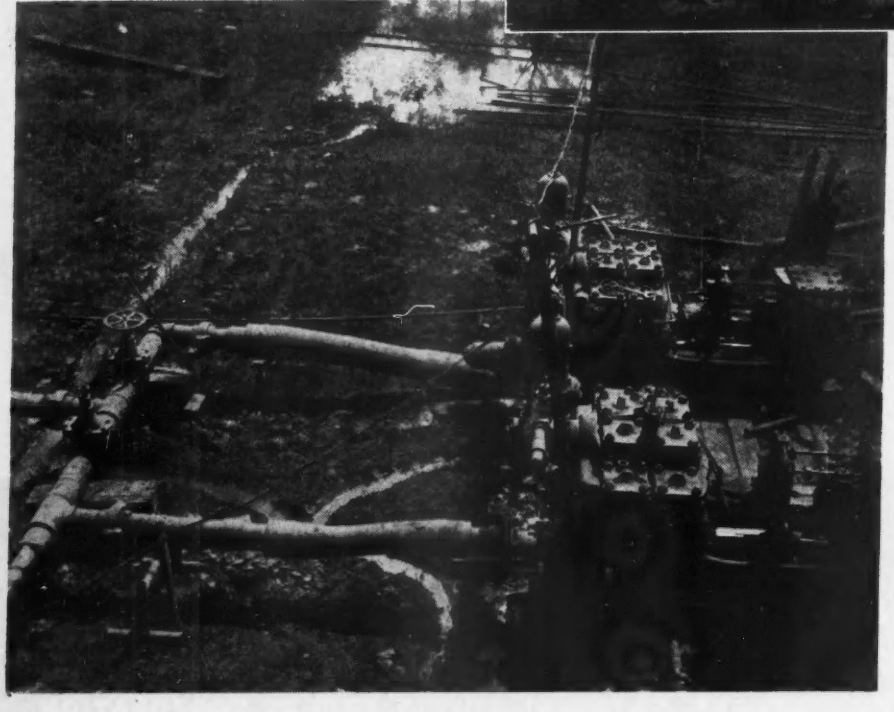
The third boat is used for fresh water storage as supply "pond" for the boilers, and also to provide supply when drilling out cement with water instead of mud.

The boats require only a minimum of blocking, as the area of their bottoms is ample to support them, even in muddy ground. When the boats are to be moved, they are winched onto trucks and hauled to the new site, the shape of their ends aiding in this shift. To move, only the unions in the hose lines and in the mud and water lines need be broken, each run of piping being carried intact on the boat to which it is attached during the drilling operations.

Decking over one end of one boat provides storage space for mud additives and a platform on which crew men may stand while feeding materials into the hopper or adjusting the jet gun.

The only maintenance required by the boats is an occasional coat of paint. Dents normally received during moves are ignored, but may be straightened out with a torch if considered serious enough. Leaks or holes accidentally punched in the boat plating are easily welded. The all-steel construction provides for attaching additional pipe or fittings when and where desired, and will permit the bottoms to be shod with steel skids where it is found profitable to drag the boats and their mud contents between adjacent sites.





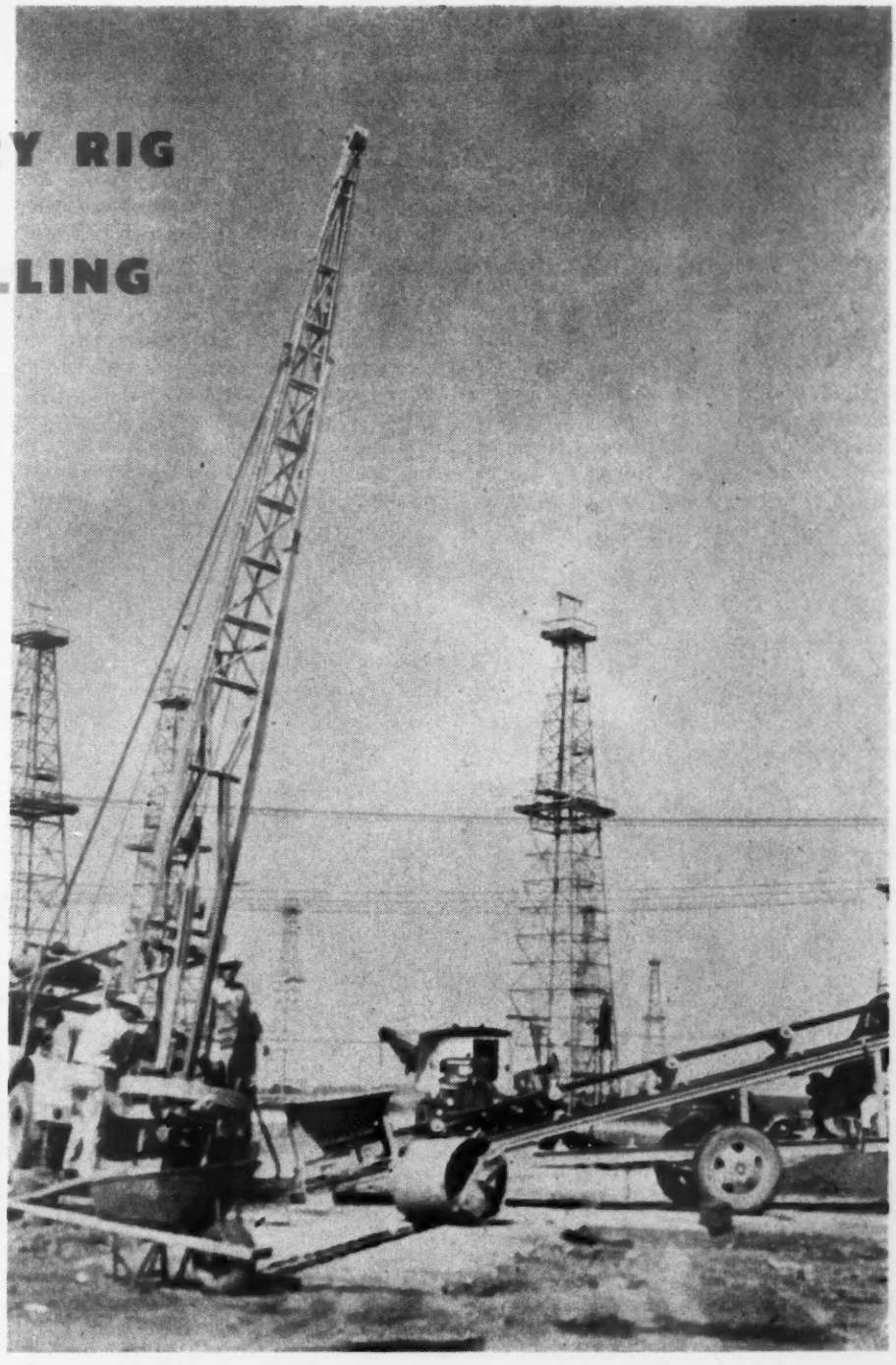
Top: The suction line is attached to the end of one boat, with sufficient drop to give gravity feed to the pumps. Space below the point of attaching the suction acts as settling basin to collect cuttings, while overhead fluid separates oil and floating trash.

Center: Mixing hopper and mud jetting gun are mounted across one end of the boat nearer the derrick, with a small area decked over for storage of materials and as working platform for the crew when adding materials or jetting mud.

Below: T-type suction manifold with usual suction hoses absorbs vibration and pound from pumps and protects relatively thin boat plate from damage.

MOBILE ROTARY RIG *for* RAT HOLE DRILLING

By JOHN C. ALBRIGHT



When the inclinable feature of the rotary table will not afford sufficient inclination to the hole, one side of the truck is jacked until the required angle is attained. Guide above table aids in maintaining slope on kelly during drilling operation.

Development of a special rig for rat-hole and conductor-pipe drilling relieves the deep-drilling equipment of a time-consuming chore, allowing the amount of time between jobs to be reduced. The special equipment is designed for adequate tilt, and also handles spoil beyond the limits of derrick foundation.

WHERE drilling is concentrated, as on town-lot leases, or when a considerable program is to be carried out, a special rig for making the rat-holes and for drilling the big bore for the conductor pipe is a profitable investment. If the surface drilling be through unconsolidated soil, clay or the gumbo which covers most of the Gulf Coast area, a unit devised by a West Coast drilling contractor is highly useful.

In the operation described, the preliminary drilling is done after a concrete apron has been poured and the cellar cast. The unit is mounted on a standard 2½-ton truck, and operates from the truck without requiring either guy hitches or special mounting.

Truck Mounted

The unit on the truck contains all the essential parts for rotary drilling, having a separate engine for motive power. Each part is similar to a deep well drilling unit, except that it is in miniature. The derrick is an A-frame with legs made of channel steel, complete with girts, sway braces and crown block. Set on short stub legs, the mast can be folded over the cab of the truck where a support attached to the front spring horns serves to carry the mast in level position when on the move. The subframe of the unit is designed for a standard width truck frame and can be mounted on any of the usual 2½-ton jobs. A substantial rack, made of pipe, is included with the subframe to fit immediately behind the truck cab, in the same position as on many oil field maintenance trucks. Guy wires are attached to this rack to support the A-frame in the vertical position desired for drilling.

While the hoist, drawworks and clutches are interesting, the rotary table is the most unusual part of the rig. It is set on a circular steel frame supported by an extension of the truck subframe

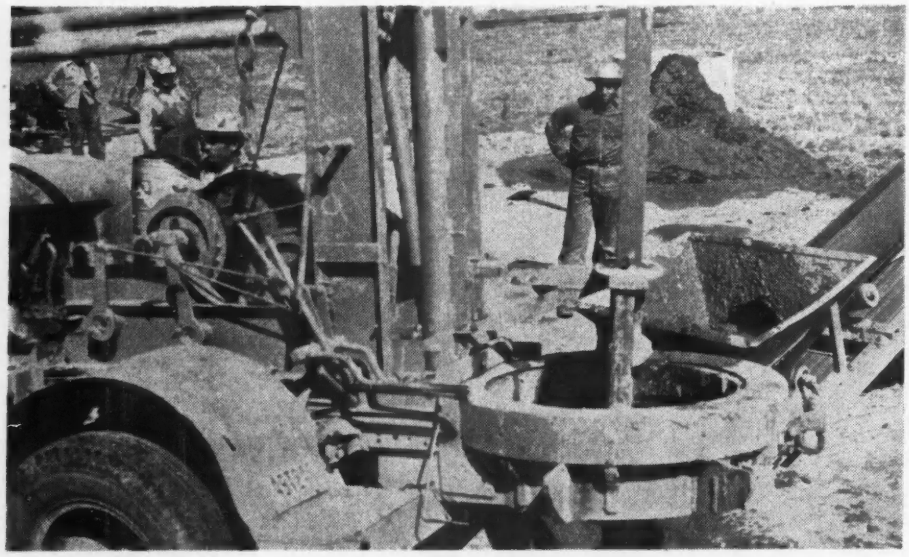
well behind the bumper position of the truck. The drive is through a shaft containing a gear parallel to the frame of the subbase, with the gear engaging a conventional circular gear in the table, covered with steel and rotating on bearings. The table has a wide throat into which the kelly bushing operates, driven by several lugs attached to the inner circle of the table-driven member. The bushing fits loosely in the rotary table to permit various degrees of kelly inclination from the vertical for drilling the rat-hole, but can be operated for straight hole drilling, as when opening a hole for the conductor pipe. To obtain a greater degree of inclination from the vertical, either side of the truck can be jacked up to further tilt the rotary table and A-frame in the direction desired for rat-hole drilling.

Drilling Head

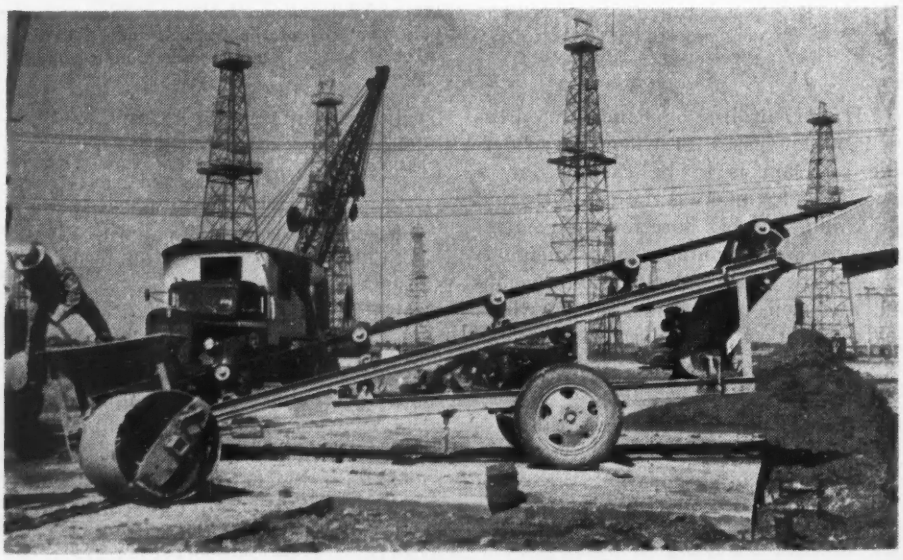
The drilling head or "bit" is a combination of a bucket and auger blades, fashioned like a post-hole auger. The bit cuts into the soil by rotation and by the weight of the kelly. Both speed and weight can be controlled at the will of the operator. The cutter blades are mounted on a hinged "lid" or bottom of the bucket having a manually operated latch for dumping the load of cuttings when brought to the top of the hole. When dumping the cuttings from the cutter bucket drilling head removed from the hole in which the conductor pipe is to be inserted, a trailer-mounted endless belt conveyor is used, and may be employed when drilling the rat-hole if conditions at the well site require that refuse material be deposited away from the rat-hole side of the well location. This unit is mounted on a single axle with the frame made of structural steel and fitted with a loop for connecting to a hook on the back of a towing truck. The belt operates on standard endless belt rollers commonly installed when moving material of any sort, and is opreated by a small gasoline engine mounted on the rear of the frame and beneath the large belt-driving roller. The loading end of the belt conveyor has a steel hopper in which the load of cuttings is dumped from the drill head. When conditions are such that water is not immediately available at the well site, a tank truck accompanies the drilling unit to supply water which is fed into the rat-hole, or other excavation through a hose with the quantity controlled to suit drilling conditions.

This type of drilling rig has its advantages to both the lease owner and the drilling contractor. In the interval between the time the cement contractor completes the pouring of the pad around the well location and the arrival of the derrick and rig builders, the small rig sets both the kelly casing and the conductor pipe. The time interval between rigging up with the standard string of rotary tools and spudding in is reduced materially, so all the crew need do is to start rotating. The contractor profits by being able to begin making pay hole immediately, and the lease owner gets a well completed that much sooner.

Even when the conductor pipe must be set into hard going below the topsoil area, the earth-cutting bit may be exchanged for a rock bit, and the hole completed to the desired depth. Although the rate of such hard drilling is much slower than that obtainable with a standard rig, the advantage of being able to start making hole with the bit which will be carried to a considerable depth more than outweighs the per-foot cost of conductor-pipe bore made with a rock bit on the light rig.



Left: Illustrating method for tilting rotary table, and long support bearing used to maintain desired alignment. The guide rides up the kelly ahead of the combination bucket-bit to allow unloading through hinged blades into hopper serving the conveyor belt.



Right: In the left foreground is the special drill bit with hinged cutting blades for permitting removal of spoil. The hopper and conveyor belt transfer cuttings to beyond the limits of the precast derrick floor and permit shovel or bucket pick-up for trucking.

How to do it!

DRILLING HINTS

$10.00 is paid for each illustrated acceptable contribution. Mail to The Editor, WORLD OIL, P. O. Box 2608, Houston 1, Texas

How To—Ease Drilling Engine Placement with Specially Designed Substructure

Much labor and time is involved in setting up a heavy rig, and the placement of the heavier units on the elevated derrick floor consume most of this time. One company operating in South America designed and constructed a special substructure for the heavy steam drilling engine in order to facilitate spotting the engine in place as well as ease the job considerably.

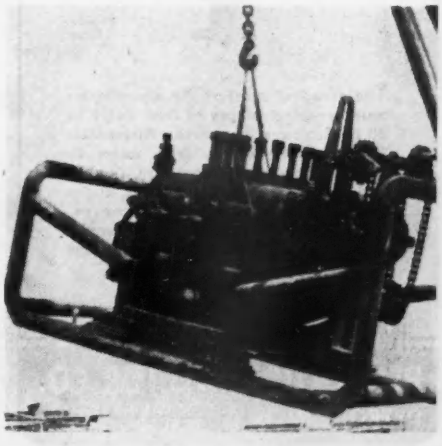
The substructure is made from the regular heavy I-beam steel to dimensions which suit the particular engine in use. Otustanding feature of the substructure is the hinge device on one end which makes it possible to lower and raise the opposite end when the supporting stanchions are removed. Two foot pedestals mounted on the skid sections as shown have a top plate welded at an angle to the horizontal member. The four supporting stanchions under the engine are made in two parts, with flanged ends so that they may be bolted in place instead of the regular method of welding the unit together. The hinged or pivot point of the structure is at the end of the unit which is located adacent to the derrick floor when set up at the well. The horizontal runners of the skid extend beyond the stanchions supporting the pivot in order that four-inch pipe may be welded at 45-degree angles to stiffen this supporting end.

When the engine is to be moved from the location, two hydraulic jacks placed under the end of the substructure shown at the right take the load of the unit and the four stanchions are unbolted and removed. While the engine is still bolted in place, the end supported by the jacks is slowly lowered until the top I-beams rest on the foot pedestals. When the assembly is in this position, the engine may be easily dragged off the substructure and the height of the lower end is such that it is about the same height as that of a truck bed. The engine is winched onto the truck and transported to the next location. In setting up, the reverse procedure is followed.

How To—Protect Major Items of Drilling Equipment During Rig Moves

Upon disassembling certain types of drilling equipment it is not practically possible to break out studs or remove parts which might be damaged when striking solid objects, such as storage docks and the like. To eliminate damage to such equipment, one drilling contractor builds shipping cages for the more important pieces of equipment. The cages are tailored for the particular piece to be protected so that it can be clamped in place without danger of slipping from the protector, no matter how roughly it is handled when moving.

The base is built with sufficient height that studs on the lower side are prevented from coming in contact with concrete pavement, and the chains and sprockets, for example, have additional protection in the form of heavy guard rails securely braced to the equipment base so that, when lifting with a truck boom, no damage can result even when the movement caused by lifting swings the load sharply against the tail roller of a truck. Illustrated is a blowout preventer mounted in a protective cradle being loaded on a truck for moving. Complete protection was afforded the studs on both the top and bottom of the preventer. The skid-type frame eased the job of dragging the unit over the ground up to the cellar.



PENBERTHY
"REFLEX"
WATER GAGE SET

For oil field, locomotive type and marine boilers. Water shows black — steam shows white; the water level is unmistakable. U-Bolt construction is strongest and simplest to service. Glass replaced by simply removing nuts on face of gage . . . unnecessary to work between gage and boiler. Conforms with A.S.M.E., Federal and State requirements when used for pressures specified by their respective codes.

This is one of the complete line of Penberthy gages that meet every liquid level gage requirement.

PENBERTHY INJECTOR CO.
DETROIT, MICH. Canadian Plant WINDSOR, ONTARIO

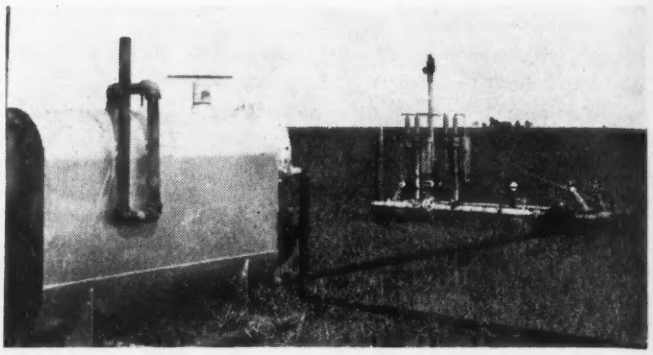
PENBERTHY
AUTOMATIC
INJECTORS

The accepted method for assuring an uninterrupted supply of feed water to oil field boilers. Penberthy Automatic Injectors will supply feed water to boilers at minimum cost, are quickly and easily installed, reliable under most severe operating conditions, require little attention and no careful handling. Highest quality design and rugged construction.

PENBERTHY INJECTOR CO.
DETROIT, MICH. Canadian Plant WINDSOR, ONTARIO

How To —

Unitize High-Pressure Heating System on Fuel Line



Where wells are drilled near an interstate gas line, it is necessary to make connections under high pressures. After the tap is made into the line in the ordinary manner, a portable heater and meter run with regulator may be employed as shown. The heater is the hot water bath type mounted on skids and connected up between the meter run and the gas connection. The water surrounds a combustion chamber which is fired with gas from the down stream side of the regulator. A return bend is used in the vent from the hot water to hold a very slight back pressure on the hot water to reduce evaporation losses.

The meter run is of the conventional type with a twenty-inch and a hundred-inch orifice meter mounted side by side and connected to the same orifice flange to permit close measurement although the gas flow fluctuates over a wide range. The regulator is installed upstream from the meters and a pop valve installed below the meters as a precaution against regulator failure. The entire assembly is fabricated in the shop and only requires a short time to set and connect up the meters and heater, and start laying pipe to the location.

How To —

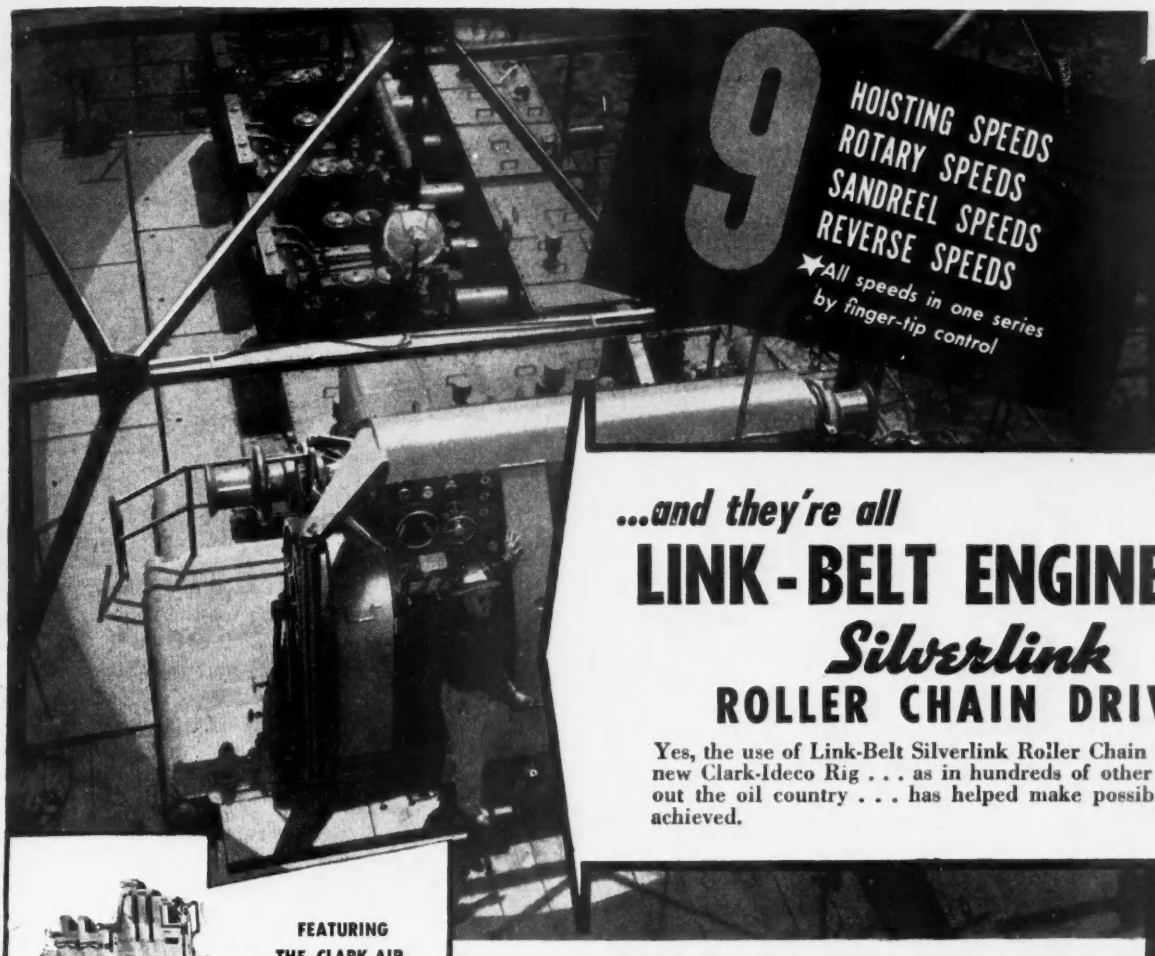
Fabricate "On Bottom" Mud Gun for Metal Tanks

When steel mud tanks are used instead of earthen pits, thorough mixing of the drilling fluid can be accomplished by a simple, manually-operated mud gun mounted on the bottom of the tank. Two-inch mud lines leading from the mixing pump connect to the tank from beneath the bottom. A packed swivel is welded inside the tank to the two-inch mud line. The male section of the swivel is fitted into a standard two-inch ell. The side outlet of the ell is equipped with an eight-inch nozzle through which the mud is ejected.

A bull plug or cap is screwed into the top of the ell, and a ¾-inch steel rod stem welded to the cap. The stem extends above the upper edge of the tank and is fitted with a handle. The cap is held in position by a bracket welded to the side of the tank. It consists of a piece of plate steel in which a hole is cut large enough to permit the two-inch cap to revolve.

With this assembly, it is possible to rotate the nozzle through 360 degrees by turning the handle above the tank.

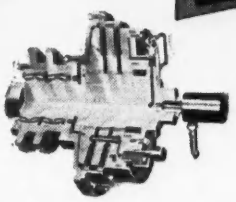
When mixing is desired, the derrick man can start the mud mixing pump and jet the fluid through the nozzle located on the tank bottom. By slowly rotating the handle on the assembly, thorough mixing is accomplished.



...and they're all

LINK-BELT ENGINEERED *Silverlink* ROLLER CHAIN DRIVES

Yes, the use of Link-Belt Silverlink Roller Chain Drives in this new Clark-Ideco Rig . . . as in hundreds of other rigs throughout the oil country . . . has helped make possible the results achieved.



FEATURING THE CLARK-AIR, DIRECT-ACTING CLUTCHES

All drives in the draw works, transmission and compound are equipped with Clark-Air Friction Disc Clutches which are actuated by air pressure applied to a direct clutch piston. This permits smooth, positive clutch engagement and instantaneous speed changes without bringing the rotating parts to a complete standstill.

MECHANICAL AND OPERATING FEATURES

1. Simple design . . . only one moving part.
2. Air-actuated . . . equalized pressure on plates.
3. Positive, cushion engagement . . . smooth operation.
4. No adjustment required . . . self-compensating for wear.
5. Torque controlled rotary drive . . . no twist-offs.
6. No double clutching . . . no toggles . . . no pins.
7. Rugged . . . durable . . . low maintenance cost.
8. Heavy-duty . . . self-cooling.

CLARK-IDECO PR-1000-C and PR-1350-C

Ultramodern Power Rigs

They're smooth . . . they're POWERFUL . . . they're the closest approach yet to ideal flexibility! The nine speeds of Clark-Ideco Power Rigs permit use of the most favorable speed for each operation—hoisting, rotating and operating the pumps.

All controls are actuated by air and are group-mounted at the driller's position. Speed changes may be made either selectively or progressively. Speeds may be increased or decreased by turning the control wheel either forward or backward directly to the desired speed. Intermediate speeds need not be engaged. Between each speed there is a positive neutral.

Clark-Ideco Power Rigs are designed for an input of 1000 or 1350 hp. *Get the full story of this amazing new rig.* See your nearest authorized distributor or write for Bulletin PR-C-47.

IDECO
ONE OF THE DRESSER INDUSTRIES

AUTHORIZED DISTRIBUTORS

Republic Supply Company
American Pipe and Supply Company
Mid-Continent Supply Company
Howard Supply Company
International Derrick & Equipment Company

INTERNATIONAL DERRICK & EQUIPMENT CO.
Dallas, Texas Columbus, Ohio Torrance, Calif.
Export: 122 E. 42nd Street, New York 17, New York 10,862

LINK-BELT COMPANY
Indianapolis 6, Dallas 1, Houston 2, Kansas City 6, Mo., Los Angeles 33, New York 7, Toronto 8.
Offices in Principal Cities.

LINK-BELT
CHAINS AND SPROCKETS
A Type for Every OIL INDUSTRY SERVICE

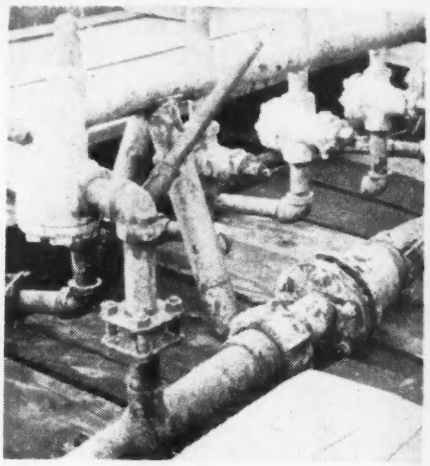
How To—

Manifold Mud Line for Auxiliary Connections

A take-off header supplying mud under pressure to several parts of the drilling rig is employed by a contractor desiring to save time and material. The header contains pressure taps for all anticipated uses, such as mud mixing hopper, mud guns, etc. Each line is equipped with nipples and plug valves to control and direct the flow of the fluid.

The header is made of four-inch hydraulic pipe supported by an "A" frame containing a pipe saddle at the apex of the support. The timber floor provides adequate footing for the support. A master plug valve controls the flow of mud into the header, and is attached to the latter by means of a sleeve coupling which is capable of withstanding vibrations set up by the pulsing line. Much of the pulsation in the main mud line to the stand pipe is eliminated through the installation in this line of a rubber hose section similar in construction to the rotary hose. The hose is connected to the main line through a flange coupling and a union, the opposite end of the hose being connected to the mud pump discharge through a similar arrangement.

The manifold is unitized and can be set up and dismantled by merely disconnecting the sleeve couplings on the take-off lines. The valves and nipples are carried permanently with the header. This eliminates much of the time required to connect up such a unit.



Regan's New Compact

Combination Hook

of Forged Alloy Steel

Send for this fully descriptive New Bulletin on this Sensational Combination Hook

Proved by two years of actual field operation

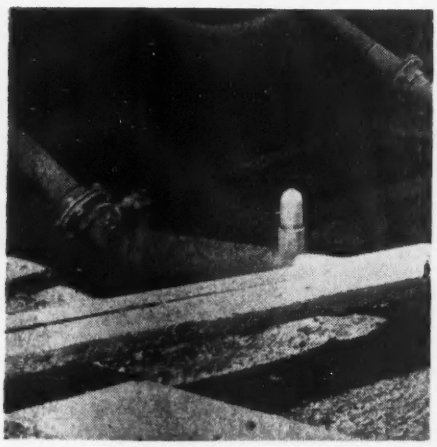
Regan Forge & Engineering Co.
SAN PEDRO, CALIFORNIA, U. S. A. — HOUSTON, TEXAS

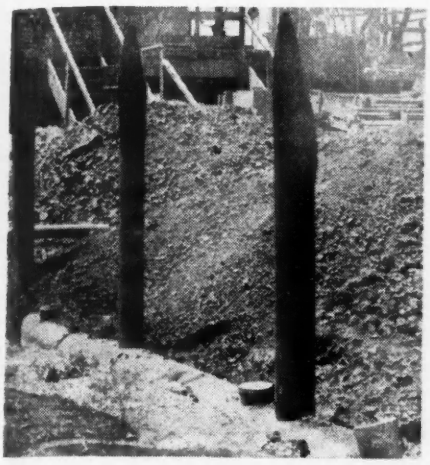
Exclusive Mid-Continent Representatives:
Hunt Tool Company, P.O. Box 1436, Houston, Texas.

Exclusive Export Representatives:
Hunt Export Company, 19 Rector Street, New York City, N.Y.
Avda Pte. R. Saenz, Pena. 832, Buenos Aires, Argentina

How To—

Muffle Engine Exhaust





A muffler and exhaust pipe leads can be constructed of common oil field piping which will suffice for either diesel, gasoline or steam engines, and operate as efficiently on one as any of the other types. The muffler itself is made of a joint of 20-inch pipe closed at each end with ordinary flat welded heads. The ports to permit escape of burned gases, or steam are set vertically, or at right angles to the body of the muffler, and are made of six-inch line pipe. The opening is made by a long sloping angle cut.

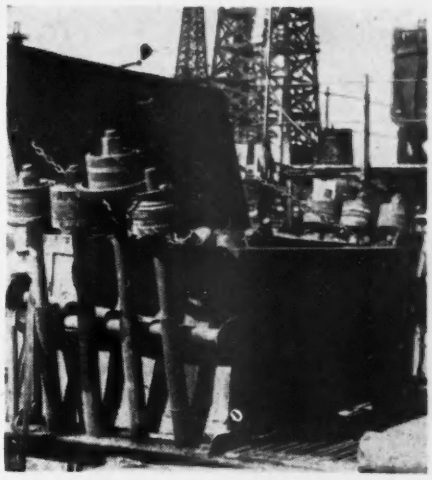
The leads from the engine manifolds are made of four-inch pipe attached to the muffler at an angle of approximately 45 degrees, and fitted with ordinary four-bolt flange unions. At the engine end, flanged unions are provided to attach the flexible tubing from the exhaust manifold so that no extreme care need be exercised when making up the assembly. This muffler, operating on diesel engines is extremely quiet under full load, and is used principally in residential areas where town-lot drilling is in progress. It acts not only to reduce the exhaust noises, but also reduces the fire hazard of engine exhausts near the well where gas may be present.

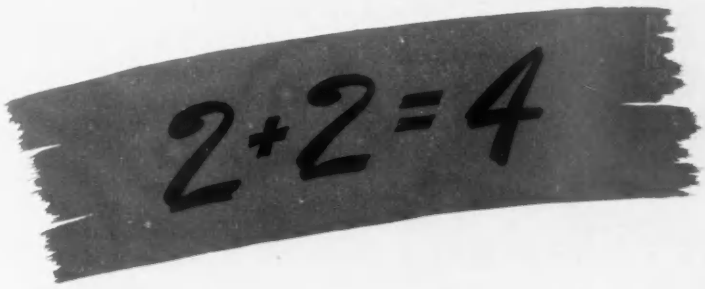
How To—

Store Mud Pump Pistons

When a mud pump goes down due to piston trouble, down time can be substantially reduced by keeping replacements nearby ready for use in convenient rack sockets attached to the tool and spare parts box. A narrow platform welded to the skid base of the tool box at either or both ends supply a base from which to weld pipe nipples of the proper length and inside diameter to receive the pump piston rods. When a cushion of soft rope or wiping rags is placed inside the pipe nipple, damage to the rod threads is eliminated.

The nipples are long enough to provide protection to the entire length of the rod which works through the rod packing in the pump. By filling the nipple with oil, the threads and polished rod are protected from rust, dust and rain. Wrapping an oiled rag around the piston rod at the top of the pipe nipple rod case further protects the polish rod surface.





Simple arithmetic applies to rods and liners too. Excellent materials plus excellent workmanship, testing and hardening methods pay off with excellent results!

MACHINING
+
HARDNESS

More Operators are Discovering the Efficiency of JP RODS and LINERS

Add up the qualifications of JP Rods and Liners. You'll find—JP uses top-quality mateiral . . . JP's expert oil country machinists know how to tool this equipment to exacting standards . . . JP "hardens" each and every JP Rod and Liner by a patented process and then subjects them to approximately 600 (or better) Brinell test.

For these reasons, operators all over the world are getting far better than desired results from JP Rods and Liners.

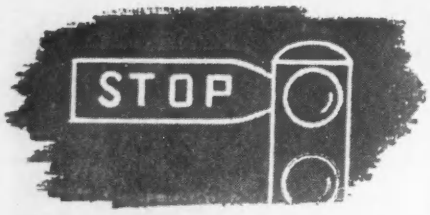
CALL — WRITE — WIRE — CABLE

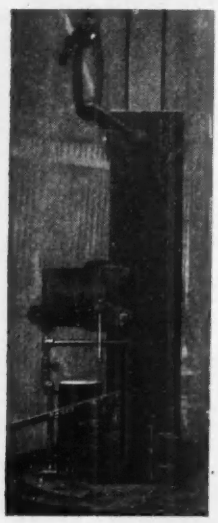
Made to A.P.I. Standards, JP Rods and Liners are available in all stock sizes (and special sizes) to fit any slush pump. For information on sizes and prices—ask for our New Catalog or give us your specifications.

JP

J P Machine & Tool Company

1534 S. E. 29th | P. O. BOX 4968 TEL. 6-8700 | OKLAHOMA CITY



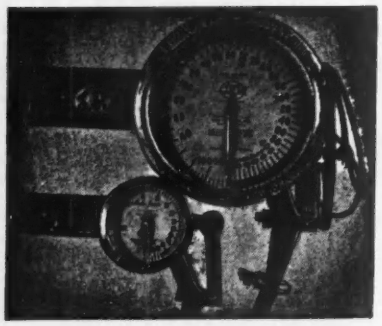


Don't haul Kellys, Drill Pipe, and Drill Collars to the Shop for taking out kinks and bends. . . Straighten them easily and quickly while they hang vertical in the derrick by using a . . .

BAKER *Portable* KELLY STRAIGHTENER

ASK THE *BAKER* MAN

LINE SCALES



20 MODELS to choose from

(Above) Super 500,000# capacity, 14" dial. (Below) Packer Special, Capacity 40,000#, 6" dial. 18 other models for every drilling, well servicing or work-over need.

With a Line Scale you know the pull on the line, and the weight on the bit in pounds. Accurate, sensitive, rugged and economical.

Line Scales are dependable, even in areas of rapid temperature changes. Repeated tests prove the accuracy of Line Scale readings under all working conditions.

LINE SCALE CO., Inc.
Phone 6-1765, 907-11 SE 29th St., Box 4245
Oklahoma City, Oklahoma

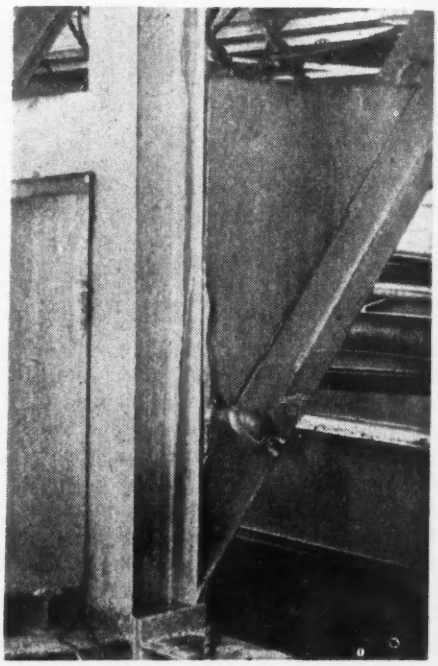
DRILLING HINTS

How To—

Collect Crank Case Oil with Centralized Container

When gas, gasoline or diesel engines are mounted on the substructure of the rig, drained oil from the crankcases can be disposed of easily and without destroying the appearance of the rig when a receiver is placed in the supporting members of the rig unit. The receiver is "tailor" made for this rig, being set into an angular space under the radiators of the engine. It is constructed of sturdy sheet metal with a drain cock in one of the lowest corners.

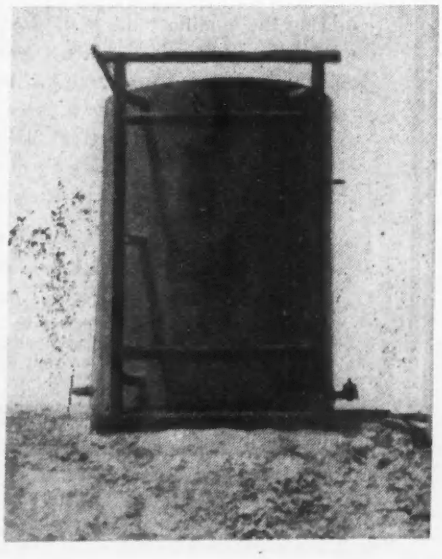
To provide ease of drainage and simplicity of operation, a large filler opening is placed in the top cover. From this opening, flexible metal tubing is run, when required for crankcase draining, from the opening to the drain plug of the crankcase. As the crankcases are drained periodically when operating steadily, the amount of oil accumulated is considerable. Oil thus collected may be used on open chains, sprockets, and other moving parts on the rig.



How To—

Skid-Mount Storage Tanks

Loading, transporting and unloading thin-walled tanks used to store water, fuel or mud, requires patience on the part of the transportation crew if the tank is to remain in good condition. In order to facilitate handling such tanks, one drilling contractor welded a skid directly to the tank, thereby providing a cradle for the tank and a means of pro-



CASING... COMES OUT EASY!

with

Simplex GEARED JACKS

● Pulling casing, skidding rigs and other heavy-duty lifting jobs are done faster and easier with Simplex Geared Jacks. These single-acting, ratchet-lowering jacks are famous for power, safety and ruggedness. Furnished with oval sockets and extra-strong 6 ft. oval hickory poles; capacities to lift up to 35 tons as much as 16 inches. Ask your supply house for details, or write for Bulletin Oil-45.

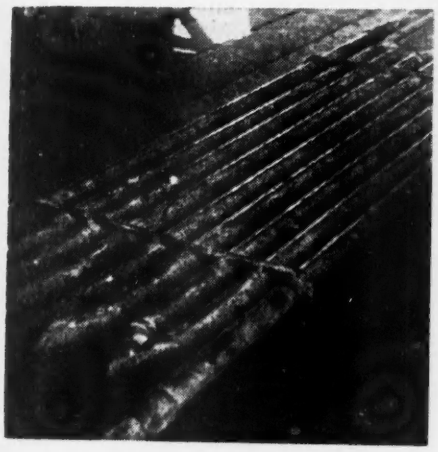
Simplex
LEVER · SCREW · HYDRAULIC
Jacks
TEMPLETON, KENLY & CO.
1032 So. Central Ave. Chicago 44, Ill.

tecting it during loading and unloading operations.

The skid is made from salvaged four-inch pipe welded to form a rectangular frame and braced by two additional cross sections. Six short nipples are welded directly to the sheet-metal tank at such an angle that when the skid is welded to these nipples the cross braces rest against the tank plates. The skid becomes a permanent part of the tank, as illustrated. After the tank is unloaded and spotted in position, it is "up-ended" and made ready for connections. When lying in a horizontal position, the tank may be dragged without injury to the thin walls. Rough handling does not damage the tank, and the skid eliminates any possibility of the tank rolling off a truck during moves.

How To—

Heat the Tool House



The problem of heating a large tool house or change room which of necessity has to be kept open to the weather a portion of the time was solved in an efficient manner by one drilling company. A bank of nine closely-spaced lengths of two-inch pipe was welded together to form a flat-lying coil which was laid on the floor in or near the center of the room. Exhaust steam or hot water taken from the drilling engines, pumps or other auxilliary equipment was directed through the system. The installation was inexpensively assembled, no effort being made to provide return bends at each reversal of direction. Adjacent ends were bent slightly and cut off at the appropriate angle for welding. Coils were held together as a single unit by welding two lengths of sucker rod across the bank as shown.

This "Rubber" Hose is 67% steel!

716 lbs. of steel for strength—354 lbs. of rubber and fabric for flexibility—that's the efficient make up of Thermoid Powerflex Rotary Hose, built to go "all the way" in deep hole drilling!

Thirty-three *miles* of high tensile steel wire, formed into 9300 ft. of cable, and precision wrapped—and counter-wrapped, gives each length of Thermoid Powerflex Rotary Hose strength to withstand the highest pressures that may develop under any condition.

The advantages of flexibility are retained in the 354 lbs. of rubber and fabric that house the steel cable. The neoprene tube resists abrasion even better than a steel tube, and the flexibility needed for rotary work is obtained in a single, unbroken, free-flowing length of hose.

Thermoid Powerflex Rotary Hose has the strength *of steel—and the* flexibility *of rubber!*

Thermoid Products

Automotive • Industrial
Oil Field • Textile

Thermoid Company, Trenton, N. J., U. S. A.

Warehouses in Houston, Los Angeles, Wabash

Make your choice of Wing Unions from a line-up of proved winners. WECO . . . home of the *original* wing unions . . . offers the most advanced and complete line of wing unions in the world for a variety of *specific* services. You can select your tailor-made WECO Unions by size and pressure to *fit* any service. You can bank on the extra strength of WECO's *Original* design for dependability. WECO Wing Unions are made in sizes 1" to 10" and 1000 to 12,000 lb. test pressure. WECO 6000 lb. Dizzy Thread Wing Unions are made in 1" size for blowout preventer hook-ups. Specify WECO Wing Unions. They truly cover the field!

WELL EQUIPMENT MFG. CORP.
Subsidiary of Chiksan Company
Houston 1, Texas
Export Representation:
CHIKSAN EXPORT COMPANY
New York 7 Brea, Calif. Houston 1

WECO
Manufacturers and Distributor of Oilfield, Refining, Marine and Industrial Equipment

DRILLING HINTS

One advantage of this type heater, as compared to the conventional types wherein the radiator is stood up alongside a wall or extended down the center of the room, is the fact that the man can walk over or stand on top of the coils, thereby warming his feet first and permitting the heat to pass up along the entire length of his body. By being able to more quickly "thaw out" in this manner, the workman is more likely to return to his original job that much sooner.

How To—

Determine Subnormal Lubricating Pressure

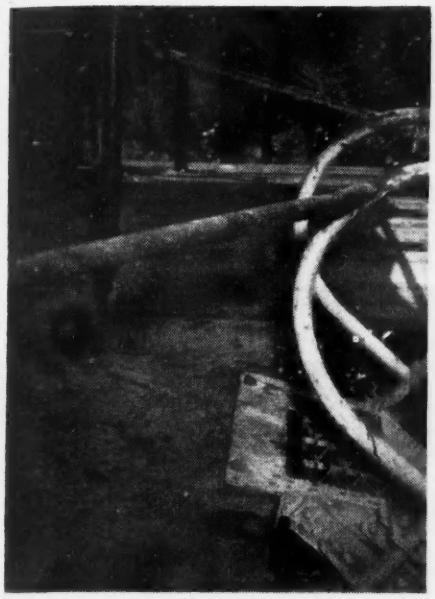
In addition to the elaborate gear shift and control panel furnished for an ultra modern string of drilling tools, one company has made an addition of a series of red lights connected with the lubricating system of the power unit engines. Switches are placed in the lines leading from the lubricating pumps to the various parts of the engines in such a manner that, so long as pressure exists, the contacts are open preventing the flow of electric current. When the pressure drops below a predetermined pressure, forty pounds for example, the points of the switches close, causing current to light up one of the red lights.

These lights are arranged in a battery just above the control panel and the auxiliary board lettered so the driller can determine immediately which engine has developed subnormal lubricating pressure.

DRILLING HINTS

How To—

Anchor Rig Stairways



The flight of steps to one rig floor cannot slip or work out of place because it is anchored to a plate welded across the end of the skid which carries the drilling engine. The plate covers the entire skid from the cylinder heads of the engine to the beveled I-beams of the support. It is welded solidly to the beams, and so braces the skid as well as providing a solid floor.

Matching holes in the steel plate and the top angle of the step frame take two bolts which hold the stairs in place. This location of the steps is safer than their mounting at one side, where they cannot be secured until the wooden floor is complete. The steel plate is a handy work place when the engine is being serviced. It also protects the steam separator, mounted just below it, from floor drip or wash water.

The hand rail is carried in pipe sleeves on the roof supports, and is bolted to the stair railing, to form a complete enclosure of the working area.

How To—

Salvage Drilling Mud

Drilling mud which always accumulates in the cellar at the well is sometimes difficult to remove and salvage at the same time. It frequently has no valuable properties, but when mixed with expensive chemicals, even a small

Famous Trio

. THEY WERE PLEDGED TO HELPING EACH OTHER

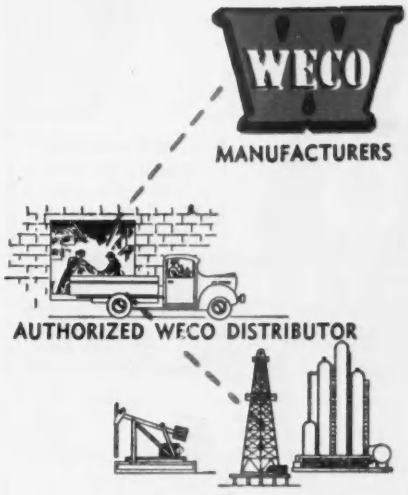
another Famous Trio

WORKING TOGETHER FOR THE GOOD OF ALL

It was back in the 16th Century that France's Famous Three Musketeers set a pattern of working together that symbolized the acme of co-operation. Today . . . nearly 400 years later . . . their names are still familiar to the world . . . still the symbol of cooperation . . . equally famous in the Mid-Continent or Middle East.

Far younger in years than the team of the Three Musketeers but equally determined in their efforts of cooperation and service to the oil country is the team of manufacturers, distributors and Oil Men who work together in the interest of the petroleum industry . . . to provide better products, better service, more petroleum.

Equally as famous in the Mid-Continent or Middle East as the Three Musketeers are the products your authorized WECO distributor handles. These quality WECO Unions, Blocks and Compounds . . . Chiksan Products, Anchor Burners, Okadee Valves, Hamer Line Blinds and Valves have gained a reputation for dependability throughout the oilfields of the world based on trouble-free service year after year. And behind each WECO Product you buy stands the service and facilities of WECO and your authorized WECO distributor . . . working together with the Oil Men in the interest of the oil industry.



Sold Through Leading Supply Stores

WELL EQUIPMENT MFG. CORP.
Subsidiary of Chiksan Company
Houston 1, Texas
Export Representation:
CHIKSAN EXPORT COMPANY
New York 7 Brea, Calif. Houston 1

WECO
Manufacturers and Distributors of Oilfield, Refining, Marine and Industrial Equipment

PORTABLE! SAFE! ECONOMICAL! LONG LIFE!

See the WELDERZ FREND in action! Acetylene gas is generated economically and efficiently. Built to meet all requirements the WELDERZ FREND is the generator welders have always wanted and needed . . . a generator that is ACTUALLY PORTABLE . . . a generator that will hold a CONSTANT PRESSURE . . . a generator where there is no "hot belt" . . . a generator that has no complicated mechanism to keep clean and adjusted . . . these and many other features make the WELDERZ FREND the GENERATOR you've been looking for!

Welderz Frend

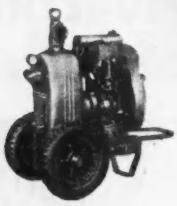
PORTABLE ACETYLENE GENERATOR

Mfd. By WELDERZ-FREND GENERATOR CO.

LUBBOCK, TEXAS

Sterling

PUMPS • HOISTS • LIGHT PLANTS



DEPENDABLE
RUGGED
SIMPLE
•
SAVE
MONEY
SAVE
TIME

STERLING QUALITY

For more detailed information see pages 3620 and 3621, Composite Catalog.

STERLING
MACHINERY CORPORATION
405-13 SOUTHWEST BLVD KANSAS CITY 10, MO.

Panhandle Headquarters
for
HINDERLITER
and
MURRAY
FISHING TOOLS

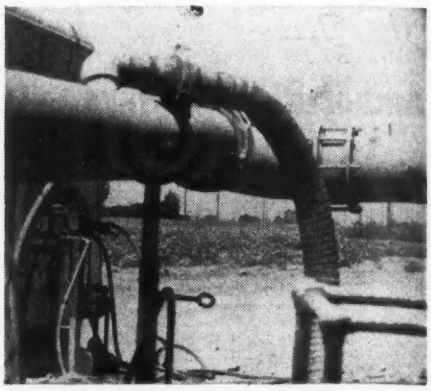
★

Complete stock of Hinderliter Patented Casing Head Hookups.

NICHOLS
TOOL COMPANY
(NICK) NICHOLS, MGR.
Stevenson & Cedar
Phone 350 Borger, Texas

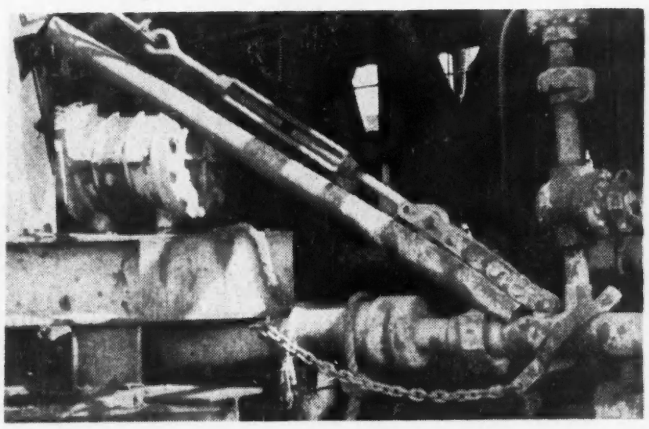
quantity is worth the effort of recovery. One drilling company employs a jet to remove the accumulated mud from the cellar, and the dscharge is made through a length of armored hose leading to a nipple and coupling permanently connected to a joint of the pipe which conducts the returns from the well to the shale shaker, so that the fluid can be again placed in circulation.

The jet is operated by water pressure which lifts the mud from the cellar and flows it into the mud return ditch through a flexible hose.



How To— Stabilize Mud Pump Discharge Line

To prevent longitudinal creep, or movement of the hydraulic line from the mud pumps to the derrick standpipe, one company solves the problem with a combination of ideas. A bracket is attached to the line, upstream from the connecting union, to which one end of a turnbuckle is bolted. The opposite end of the turnbuckle is attached to a convenient point on one of the derrick legs. Between the turnbuckle and the pipe at one end, and the derrick leg at the other is placed a heavy piece of tubing, shaped to fit each point of contact. Thus, one attachment braces the other, preventing movement in either longitudinal direction.



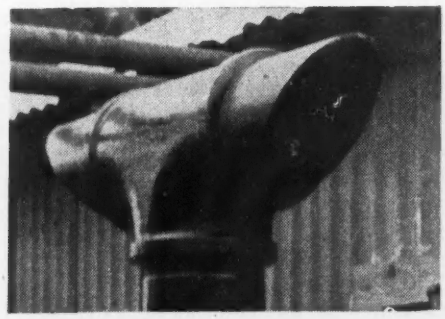
As a safety measure, a chain is connected to the base of the derrick and to the hydraulic line, so that if a rupture of connections occurs, the pipe will not thresh around, endangering crewmen.

How To— Screen Engine Intake Air

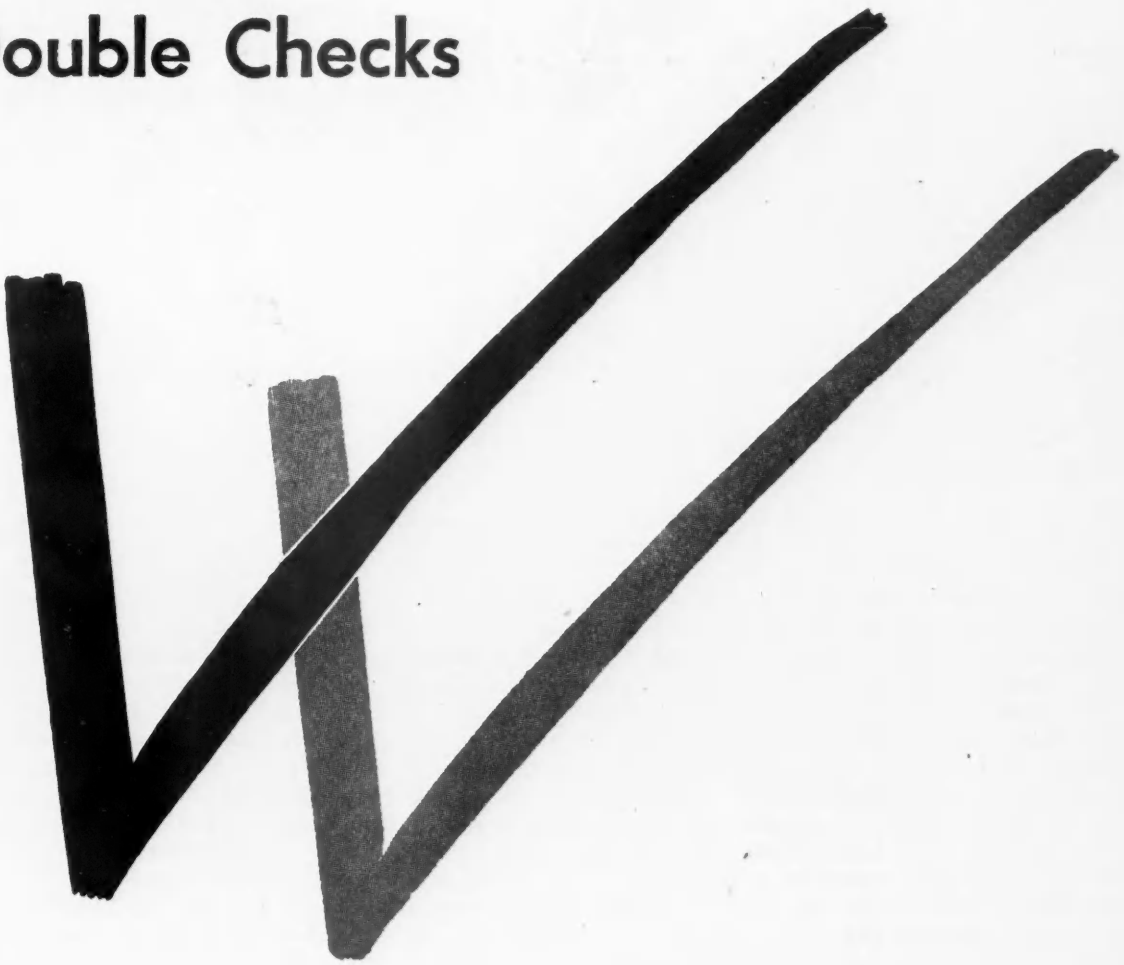
Air for the engine powering a group drive is brought in through a 6-inch line extending outside the room housing the unit. The line is brought outside below ground, with a riser extending about seven feet upward to a point just below the eaves. A tee is screwed to the riser to extend horizontally and parallel to the roof line. Into the run of the tee are screwed two 12-inch long nipples, each beveled and with the bevel facing downward.

A ring of ¼-inch rod is welded inside each nipple at a point about even with the end of the threaded portion. Disks of common 16-mesh screen cloth are pushed against these rings, two screens being used in each pipe for greater strength. The screen disks are held in place with spring rings, pushed into the nipples and against the welded stops. These retainer rings are salvaged piston rings from an engine with 6-inch cylinders, the rings being hammered to expand them and make a tight fit against the wall of the nipple.

The screens stop bugs, flying leaves and other trash, and are easily cleaned or replaced through the open or intake end of the nipples.



Checks and Double Checks



The E-C Inclinometer

is not only self-checking, but can double check at the same time

Call us to discuss your well surveying problem

SPERRY-SUN WELL SURVEYING COMPANY

Offices: Philadelphia, Pa.; Houston, Corpus Christi, Falfurrias, Marshall, Odessa, Texas; Lafayette, La.; Long Beach, Bakersfield, Calif.; Oklahoma City, Okla.; Moulden Oil Field Services, Casper, Wyo.

Newer Techniques in AERIAL SURVEYING

Part 4

Geologic Interpretation of Aerial Photographs

By DR. SHERMAN A. WENGERD

INTERPRETATION of geology from aerial photographs is based on a critically descriptive approach backed by an excellent background in structural and geomorphologic analysis based on wide experience in field geology. As such, successful interpretation invades the field of three-dimensional imagery and philosophy. All these factors which make interpretation of aerial photographs successful are present in geologists to varying degrees. The ability to construct accurate base maps from aerial photographs and to place thereon the interpreted data with precision has been gained by many younger geologists in their experiences with the Army, Navy, and Marine Corps.

So far as the writer has been able to ascertain, there are few new techniques in geologic interpretation. The new techniques arise in the application of engineering precision with which interpreted data is represented in map form. There are few better techniques than those resulting from hard work and experimentation with photographs in the field and laboratory. The gamut of uses to which geologists put aerial photographs runs from the preliminary one of finding one's way around an area, to a final examination and mapping from photographs alone ([104]Loel—1938). Suffice it to say that detailed geologic interpretation can be applied readily in areas where sedimentary contacts and structural features are plainly visible or reflected by form, vegetation, or soil patterns ([84]Belcher—1945). The factor of visibility eliminates most heavily wooded areas, grassy lowlands and swamps where rocks are not clearly exposed, and some coastal plain areas or alluvium-filled valleys where bed rock is not visible. Drainage patterns reflect broad regional structures on the coastal plain of Northern Alaska and often are sufficiently diagnostic to enable the discovery of salt domes on the Gulf Coast of the U. S.

Interpretation is most successful in areas where the geomorphic expression of underlying rocks is directly indicative of their structural and sedimentational or lithologic characteristics. It is evident that the exploration of a block or concession from the air falls into several rather definite steps; namely, flight check or reconnaissance photography of the whole area; photographic interpretation to delineate areas where detailed geologic interpretation from precise vertical photographs is possible; delineation of other areas where a combination of office interpretation and surface mapping must be used to do the geology; choice of those areas where the photographs are of no interpretative aid and can be used only to aid the geologists in exploring the area while detailed surface work is done.

Qualitative Interpretation

The present status of most geological interpretation from aerial photographs is mainly qualitative. Oblique and vertical photographs are amenable to the plotting of contact strikes and the estimation of strata dip. Contacts can be traced for transfer to ordinary base maps, either in the office from photographs or in the field with the aid of photographs. If relief of the terrain is low, the flight altitude and focal length can be used for scale and simple orthographic maps prepared showing geologic contacts, strike and dip symbols, and the structural axes ([103]Fitch—1942); or these features may be interpreted and delineated directly on the vertical photographs and a crude matched mosaic constructed. Overlays (tracings) of these crude mosaics are used often as bases for geological maps. If detail is sufficient, an interpretative geologic column can be built up, thicknesses computed, dip computed, and structural axes plotted with enough accuracy to serve as field guides to problem areas and locations for field measurement of dip, strike, and stratigraphic sections.

Obliques can be treated in the same manner by computation and construction of a Canadian grid which enables the interpreter to trace the detail that he interprets directly onto an orthographic projection. By plotting from only a few well-chosen horizon obliques, a qualitative picture of the geologic terrain can be built up over a wide area if topographic relief is low. Interpretation of obliques is generally easier, but reduction of data to the map plane is more difficult by simple graphic methods than similar work on vertical photographs. High relief terrain does not lend itself to simple graphic plotting with the Canadian grid. More complex graphical plotting methods using techniques devised by David Landen of the U. S. Geological Survey are, however, available for work on obliques covering mountainous areas ([85]Landen—1945).

Quantitative Interpretation

The quantitative interpretation of aerial photographs completes what qualitative reconnaissance interpretation must leave undone. It is in quantitative measurements that the full value of photogrammetric engineering can be utilized by the photogeologist. Graphic methods and trigonometric solutions will yield remarkably accurate dip and strike measurements from both vertical and oblique photographs if some ground control is available to provide exterior orientation of the photographs, and if

ground scale is known, for thickness, slope, and dip computations.

Two excellent books ([6]Eardley—1942) ([25]Smith—1943) have summarized the methods which can be applied for extraction of geologic data from aerial photographs, hence repetition of well-known interpretative principles will not be made in this paper.

The outstanding problems in an interpretative job are accurate elevation determination and geographic position on the earth's crust. Vertical field control is necessary for the former, and horizontal field control is necessary for the latter. By bridging techniques discovered in radial-line triangulation and Multiplex mapping, both problems can be solved for control extension. Oblique photographs often provide better vertical control data for bridging than do vertical photographs because they cover more area and relate in one perspective a greater number of topographic elevations which can be measured by the photo-alidade ([30]Chich-Cho—1941). The majority of applications of the photogrammetric instruments have stressed topographic contouring, whereas the geologist needs far less elevation data than a detailed topographic map presents for constructing structural geologic maps, detailed cross-sections, and for making strike-dip measurements ([8]Desjardines —1940) ([9]Desjardins and Hower—1939). Selection of contact elevations, measurements of strike and dip, construction of a columnar section, and location of rock outcrops can be performed by use of spot data obtained with the Multiplex, KEK streoscopic plotter, Stereocomparagraph, or the Brock and Weymouth process applied with geologic interpretation. Use of these modern photogrammetric techniques saves needless field work in easily interpreted areas. Geologists have found photogrammetric engineering an excellent tool in gaining precision in quantitative applications of qualitative geologic interpretations.

Planned Aerial Photogrammetric Programs

The oil industry only recently has made planned aerial photogrammetric aids an integral part of exploration programs. A recent cooperative project by six major companies covering the foothills of Alberta augurs well for the future of aerial applications. The well-rounded photographic exploration program which was used on the Canol project combined the experience of two widely-known photo-geologists, Louis Desjardins and H. T. U. Smith. The Navy's program for development of Naval Petroleum Reserve No. 4 in Alaska was accelerated by adoption of an aerial photogrammetric program. Application of precise aerial photography

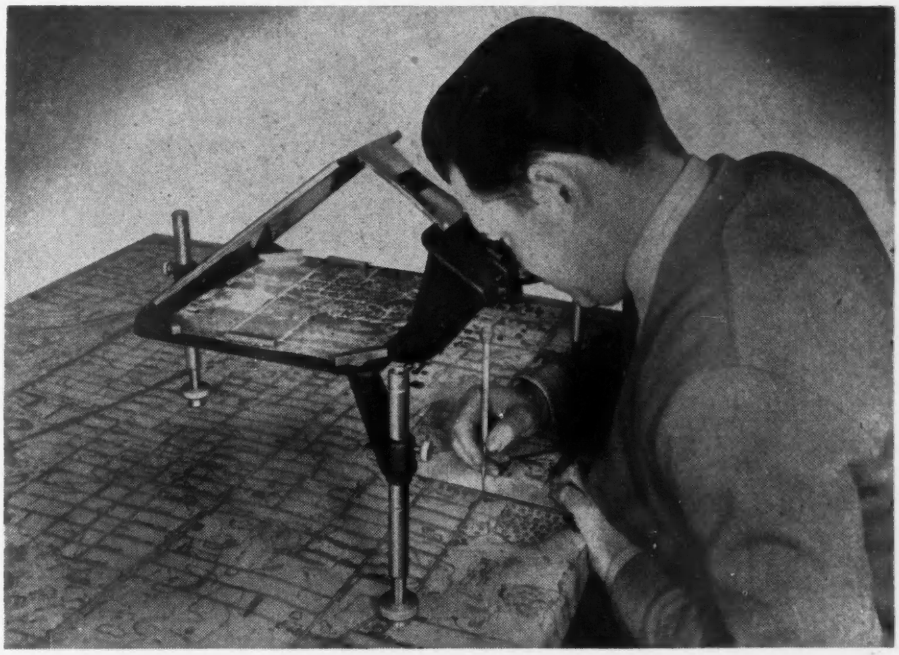


Figure 5. The Vertical Sketchmaster used in tracing planimetric detail from vertical photographs to base sheet. Designed by Buckmaster of the U. S. Geological Survey.

Photo Courtesy Abrams Instrument Company

over several large concessions has been made by one company over its Venezuela holdings. The oil industry is realizing that aerial reconnaissance of foreign holdings will not be made by the governments within whose jurisdiction the industry's unexplored concessions fall. This condition has led to wider application of aerial photogrammetry to oil exploration in Canada, South America, and the Near East than in the U. S. The U. S. Geological Survey has supported wholeheartedly the science of photogrammetric engineering as applied to topographical mapping, but little application has been made of all available geologic interpretation techniques to the efficient solution of problem areas through the use of experienced photo-geologists. Planning techniques which may be applied in areas of interest to the oil industry will be surveyed in this section of newer photogrammetric methods.

Reconnaissance Coverage

Concessions and large lease blocks in unexplored areas are often taken on the scanty evidence supplied by examination flights over an area. Any geologist who has flown over many different terrains is quick to recognize structures outlined by streams, vegetation, and visible rock contacts. Knowledge of the existence of such structures in potentially petroliferous areas has led to check flying of the area and direct examination from the air. Very often a small scale map is taken along and the structural axes are marked thereon.

A recent experience of this type in Alaska led to delineation of four anticlines over an unexplored area and an average horizontal error of two miles for location of their axes. Corrections were made later from Trimetrogon photographs. Spotting geologic structures on small-scale maps by direct observation without photography is, therefore, somewhat inaccurate. Planning based on such structural distribution patterns might be costly enough to pay for precise photographic coverage. Flight checking by a geologist results in one man's interpretation on an often inaccurate map. No other reference material is available after the flight is over, whereas, reconnaissance Trimetrogon or vertical coverage provides continuous reference for technical study by experienced photo-geologists and engineers. No added data are gained for construction of better reconnaissance base maps if check flying only is applied in planning for later surveys on the ground. Good small-scale photographic coverage provides an engineering guide to road building, pipe line routing, and reconnaissance geological mapping. Preliminary geological reconnaissance maps made from small-scale photographs are more accurate and indicative of areas valuable for concentrated eflort than are structural axes drawn on a check flight map.

Preliminary reconnaissance vertical photography provides data for precise flight maps in the form of planimetric maps or mosaics. Multiplex and Brock compilation processes virtually require pre-flying to gain coverage to guide later precise flying of an area. The cost of small-scale photography plus subsequent selective large-scale photography of a concession is small compared to the amount of ground survey and control which must be provided if inadequate

Figure 6. Oblique Sketchmaster in use for tracing planimetric detail from a Trimetrogon oblique wing print onto a base sheet. This instrument was designed by Buckmaster of the U. S. Geological Survey.

Photo Courtesy Abrams Aerial Survey Corporation

large-scale photography is made available owing to the lack of good flight planning.

Oblique photographic reconnaissance of an area affords much data as an aid to engineering planning. Type of vegetal cover, distribution of rock outcrops, strike of structural axes, and distance of the area from air fields, control the type of oblique photography which must be utilized. Scattered horizon obliques, if taken over geologic structures in areas of low relief, are excellent for reconnaissance interpretation and construction of simple planimetric base maps. If the obliques are taken as pairs, stereoscopic examination is facilitated in interpretation, and the stereo pairs can be used in the Oblique Height-finder or the Photo-alidade to gain spot elevations for construction of preliminary cross sections and determination of maximum closure in anticlines with bold dips.

Where the area warrants controlled oblique photography, regular oblique flight lines may be laid out to cover an area thoroughly. This type of reconnaissance photography, though it furnishes the geologist with excellent initial interpretative data, is difficult to compile into maps owing to the individual attention necessary for each oblique photograph. If an anticline is found on one or two obliques and it is desired to cover the anticline with precise vertical photography, flight lines can be computed and laid out directly on the oblique photographs through application of the Canadian oblique grids. Naval aviators, using such flight aids, have proved that precise flight lines can be followed more closely on several oblique photographs covering an area than it is possible to follow on a detailed map at a scale of 1:100,000. Photographic distortions due to relief require that flight check points in the obliques be picked in valleys which are crossed by the flight lines. If the area to be photographed with obliques has low relief and many water features, a Canadian grid can be constructed quickly for each oblique, the planimetry traced at the flight scale, and the resulting orthographic templates matched to construct a reasonably accurate reconnaissance map (*Wengerd—1945).

Maps have been made by this simple method for thousands of square miles of Alaska and the Canadian Arctic. The technique is successful in producing maps of value as flight guides for later precise vertical photography as well as plot maps for geologic data and the guidance of field control parties.

Detilting Technique

Should better maps and mosaics constructed from obliques be necessary prior to complete vertical coverage of related areas, the Forbes oblique rectifier or the N.D.R.C. oblique detilter may be utilized to make vertical photographic templates which can be controlled by radial-line methods or matched to make crude but valuable reconnaissance mosaics. Mosaics constructed from such detilted obliques can provide abundant reconnaissance aids for the geologist, pipe line engineer, road builder, field control party, and aerial photographer. Stereoscopic pairs of these amazing detilted photographs yield good stereoscopic models for examination and interpretation by the photo-geologist.

Trimetrogon reconnaissance coverage is more valuable as a unified system of producing accurate maps than the reconnaissance oblique techniques mentioned above. A succession of horizon obliques flanking vertical photographs provides enough data, when flown in regular Trimetrogon flight lines and controlled by several ground survey stations, to give excellent interpretative coverage and control for photogrammetric compilation of planimetric base maps. Naval Petroleum Reserve No. 4 in Alaska was covered with Trimetrogon photography earlier in the war from an altitude of 20,000 feet with flight lines spaced at 20 miles. This coverage provided good base maps at a scale of 1:100,000, which were used for reconnaissance flight checking of geologic structure and as flight maps for a second more precise Trimetrogon coverage in 1945 from an altitude of 12,000 with flight lines spaced at 10 miles. The 20,000-foot coverage was done under poor light conditions with snow cover on much of the terrain, making geologic interpretation difficult. The 1945 coverage resulted in excellent photographs which are easy to interpret.

Semi-arid and arid terrain, mountain terrain without tree cover, sub-arctic and arctic treeless plateaus unmasked by glacial and alluvial debris, lend themselves to Trimetrogon reconnaissance photography which can be used for preliminary geologic interpretation. An area 85 miles long and 60 miles wide flown with Trimetrogon photography can be covered with six flight lines 10 miles apart if the plane carries six-inch focal length cameras at an altitude of 12,000 feet. Small structural anomalies can be delineated and easily interpreted from photography at this scale. Flying at 150 miles per hour at 12,000 feet will result in coverage of such an area in approximately four hours, not counting flight time to and from the area to be photographed. If the area is completely unexplored, the Solar Navigator may be used to guide initial Trimetrogon photography. The direction of flight lines is generally controlled by prevailing weather conditions and geographic distribution of structural anomalies or regional trends.

In photographing Naval Petroleum Reserve No. 4, it was found advisable to fly Trimetrogon lines magnetic north-south directly across the axes of the visible synclines and anticlines. Over the Pliocene coastal plain area of northern Alaska where geologic interpretation of structure is virtually impossible, the direction of flight was entirely controlled by weather conditions. These photographs allow initial geologic examination to determine areas which require precise vertical coverage for Multiplex or KEK Stereoscopic Plotter compilation. Compilation of this Trimet-

faster rig-up time!

another 'plus' you get with **D-C DRIVE**

Rigging up and tearing down electrified drilling equipment goes faster because your rig is lighter and more compact. Power connections are simply bolted on. Control lines are plugged in. There are no pipe couplings to be made, fewer drive shafts to align. Whether you buy power for drilling or make your own, you can skid-mount most of the elements in a d-c drive and spot them around the derrick to suit the terrain. Once the hole is finished, you merely "unhook" the drive, load it on trucks and you're off to the next job. Add to this the control efficiency and overall economy of a d-c drive and you can see why more and more contractors are turning to electric drilling. Interested? You can get all the facts you want simply by calling or writing your local General Electric office. *Apparatus Department, General Electric Company, Schenectady 5, N. Y.*

Electrical connections are easily made on a General Electric d-c drive

sooner or later you'll be drilling ELECTRICALLY

GENERAL ELECTRIC

654-69

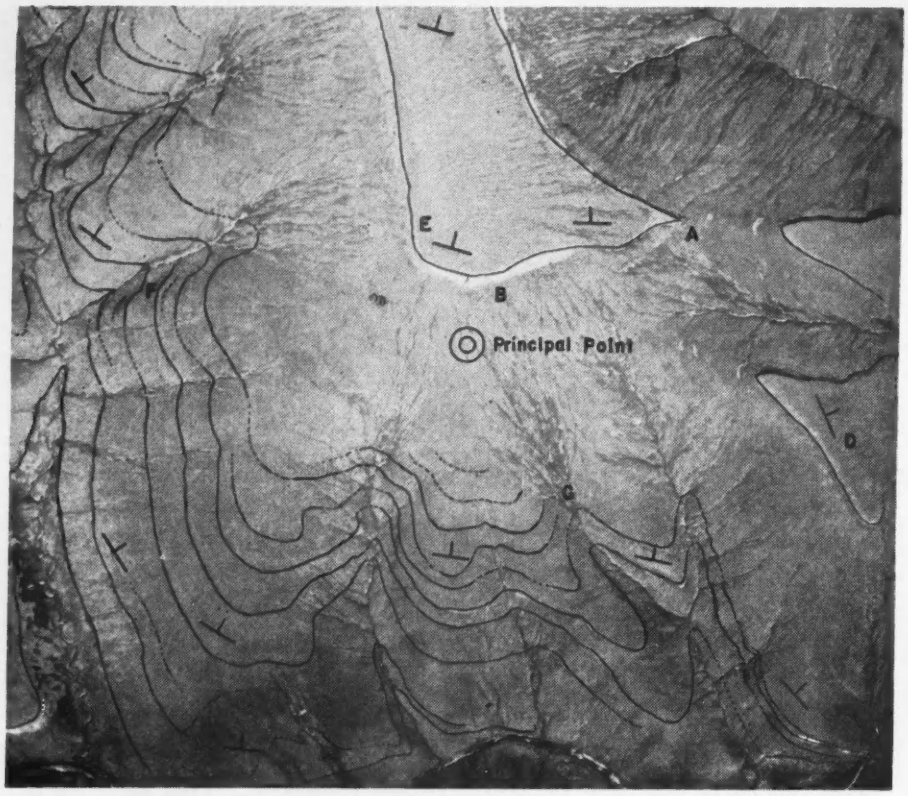


Figure 7. Vertical aerial photograph covering approximately nine square miles. An example of qualitative geological interpretation. The lines are not contours but contacts between beds presenting recognizably different topographic form due to differential erosion. Symbols show the generalized dip of rocks in the area photographed.

Point A, huge blocks of rock scattered over a shale slope.
Point B, strong developments of bentonite directly underneath mesa-capping massive bed.
Point C, local interpretation made difficult where streams head in shale beds.
Points D and E, low dip massive beds upholding the mesa form.
Point F, steeper beds in short stream valley.
Points F to C, facies change in upper sandstone-shales.

Without ground examination, this area can be interpreted as being underlain, on the bottom and left sides of the picture, by several thin sandstones with thick shale members dipping moderately to the upper right. The middle and upper right parts of the picture are underlain by a thick, rather homogeneous shale bed capped locally by remnants of a massive sandstone or limestone having a widespread layer of bentonite immediately underneath. Dip on these beds is very low. Steepening of beds along a strike from point F suggests the possibility that this photograph covers the limb of an anticline whose crest lies out of the picture to the left. The mesas appear to lie near the axis of a syncline. Subsequent field examination proved these interpretations correct and the massive bed was found to be a conglomeratic sandstone. If Multiplex or K.E.K. plotted elevation data were now to be applied to this interpreted photograph, a structural picture could be drawn up as accurately as is possible with the plane-table in the field.

rogon photography under the direction of a competent photo-geologist results in direct choice of areas for intense aerial mapping, allocation of geologic field parties to areas not amenable to photographic interpretation, planning of field control, selection of good triangulation stations, and distribution of ground control parties to gain horizontal and vertical control for use in detailed photogrammetric compilations of precise vertical photography over areas of intense study.

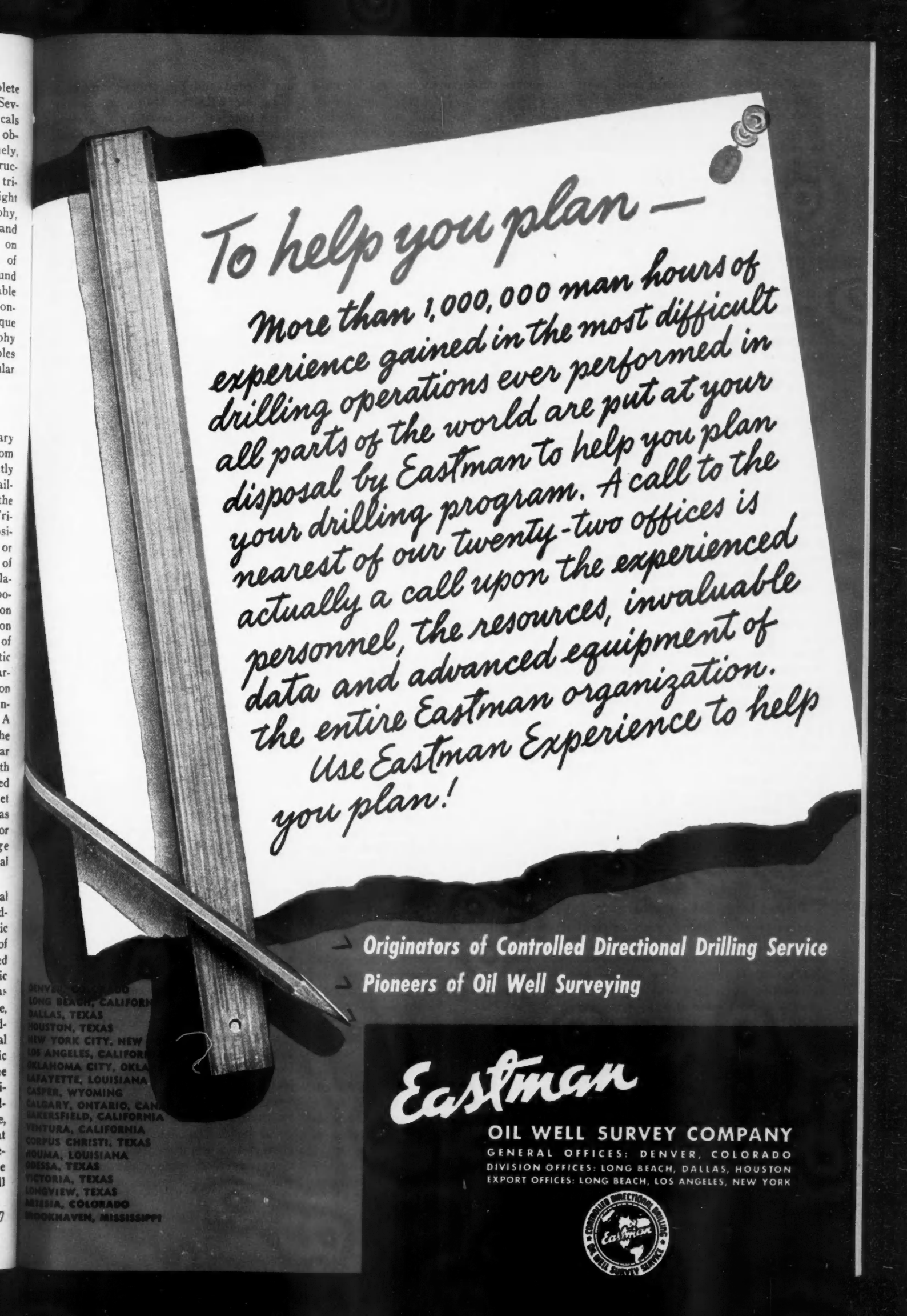
Coverage of an area by vertical photographs alone is more expensive than coverage by Trimetrogon photography. An area 85 miles by 60 miles would require 26 flight lines with 30 percent side lap if flown with a six-inch lens camera at 12,000 feet for vertical coverage. Trimetrogon coverage of the same area could be obtained by fewer flight lines thus reducing the cost. Major costs are aircraft operation, salaries, and final compilation of the photographs. Though vertical photography is sometimes more difficult to interpret, the experienced photo-geologist can do more valuable reconnaissance geology from a set of vertical photographs than he can from a set of Trimetrogon photographs.

Photographic compilation of Verticals by radial-line technique is also easier for fewer personnel than the involved compilations necessary to convert Trimetrogon photography into planimetric maps. Vertical photographs lend themselves more readily to rapid reconnaissance photo-topography than do oblique photographs. All the advantages of oblique reconnaissance photography are present in vertical reconnaissance photography, except a more easily interpreted angle of view and the necessity for more ground control to complete vertical photographic compilation. Several features of small-scale verticals make them far more desirable than obliques for reconnaissance work; namely, ease of uncontrolled mosaic construction, simple application of radial-line triangulation, production of better flight maps for gaining precise photography, better initial geologic interpretation and compilation of geologic information on the mosaic base, rapid construction of controlled mosaics if enough ground control is available, and more suitable base maps for planning precise field control locations. The cost of both oblique and vertical reconnaissance photography is determinable only when all variables can be ascertained for the particular area to be covered.

Ground Control

The type of ground control necessary to successfully compile a map from aerial photographs depends directly upon the terrain, the photography available over the area, and utilization of the final photogrammetric maps. For Trimetrogon coverage, an astronomic position for each 600 square mile oblong or square area is sufficient for control of radial-line triangulation in the compilation process. If only one astronomic position is available, a base line, expansion net, and a long distance triangulation net may be laid out to tie all parts of the area together. A Canadian geodetic survey of Baffin Island in 1943 was carried out with three small aircraft (on floats) scattered out over the lake country in the southern half of the island. A large amphibious plane supplied the three field parties while solar and stellar observations were made with zenith transits. Astronomic points scattered about 75 miles apart provided a net which was by no means as accurate as triangulation but proved adequate for reconnaissance Trimetrogon coverage and the construction of aeronautical charts.

Choice of areas for precise vertical coverage requires application of second-order triangulation and trigonometric leveling within that area for control of the vertical photographs to be compiled by Multiplex and KEK Stereoscopic plotter. Internally these smaller areas are generally surveyed by traverse, plane-table triangulation, or second-order triangulation expanded from local base lines measured from an astronomic position or a triangulation point of the long-distance triangulation net. Precision altimetry, using aneroids in accordance with the new two-base technique, provides excellent vertical control at minimum cost and cuts down plane-table control necessary for accurate photo-topographic mapping. If the small


To help you plan —
More than 1,000,000 man hours of experience gained in the most difficult drilling operations ever performed in all parts of the world are put at your disposal by Eastman to help you plan your drilling program. A call to the nearest of our twenty-two offices is actually a call upon the experienced personnel, the resources, invaluable data and advanced equipment of the entire Eastman organization. Use Eastman Experience to help you plan!
Originators of Controlled Directional Drilling Service
Pioneers of Oil Well Surveying
DENVER, COLORADO
LONG BEACH, CALIFORNIA
DALLAS, TEXAS
HOUSTON, TEXAS
NEW YORK CITY, NEW YORK
LOS ANGELES, CALIFORNIA
OKLAHOMA CITY, OKLAHOMA
LAFAYETTE, LOUISIANA
CASPER, WYOMING
CALGARY, ONTARIO, CANADA
BAKERSFIELD, CALIFORNIA
VENTURA, CALIFORNIA
CORPUS CHRISTI, TEXAS
HOUMA, LOUISIANA
ODESSA, TEXAS
VICTORIA, TEXAS
LONGVIEW, TEXAS
ARTESIA, COLORADO
BROOKHAVEN, MISSISSIPPI
Eastman
OIL WELL SURVEY COMPANY
GENERAL OFFICES: DENVER, COLORADO
DIVISION OFFICES: LONG BEACH, DALLAS, HOUSTON
EXPORT OFFICES: LONG BEACH, LOS ANGELES, NEW YORK
CONTROLLED DIRECTIONAL DRILLING
Eastman
OIL WELL SURVEY SERVICE

areas are widely separated and spirit level traverses or trigonometric leveling prove too costly, use may be made of the terrain clearance indicator and two aneroids in a traversing plane as proved feasible by the Army Air Forces in Alaska. Small areas can thus be tied together vertically and base elevations (accurate to 50 feet, plus or minus) provided, from which precise altimetry can be carried out within the smaller areas of precise mapping.

When all major control (tying together smaller areas) is surveyed and computed for latitudes and longitudes, the points are spotted on the available photography for the guidance of the photogrammetric engineer. A Polyconic or Lambert Conformal projection of the whole area at one half the flight scale (if covered with reconnaissance Trimetrogon) or full flight scale (if covered with vertical reconnaissance photography) is constructed on a large lay-down board. The photographs are prepared for radial-line triangulation, templates are laid, and resulting photo-control is then spotted on the projection. Acetate overlays may be employed to place all photo and field control on small sheets easily handled in the final process of delineating the planimetry and drawing the contours. If Trimetrogon photographs are used, planimetry is delineated from the verticals with vertical sketchmasters (Figure 5) and from the obliques with oblique sketchmasters (Figure 6). Topography is gained by photo-alidade work or through use of the oblique height-finder. Interpretative contouring is then done over the area where spot elevations have been measured by photogrammetric means. If vertical photography was used for reconnaissance coverage, a mosaic may be laid directly on the lay-down board containing the field and photo control. Direct overlays show the planimetry, and the Multiplex or KEK plotter yields rapid reconnaissance contouring at large contour intervals.

Precise Large Scale Photography

Areas of vital interest, such as routings for pipe lines, specific geologic structures, harbor and working areas, and special terranes where seismic or gravimetric coverage must be gained later, may be chosen directly with the aid of the reconnaissance photographic coverage. If a sufficient budget has been provided for aerial photography, the decision may be made to fly the whole block with precise vertical photography. This may be the better course of action, for continuous large-scale photographic reference of a whole area will provide data for all departments of a company interested in developing the concession. If the whole area is covered by reconnaissance photography and special areas are photographed for the engineering, geology, pipe line, land, and production departments, a confusion of scales and specifications is bound to occur unless the photogrammetric program is carefully planned. Whichever type of coverage is made, overall precise vertical coverage or reconnaissance photography with later precise vertical coverage of areas of geologic or other interest, the precise coverage should be planned for all engineering needs.

Experience has shown that geologic interpretation of areas, coupled with photo-topographic techniques to gain vertical data over structures, requires flying as precise as the precision desired in the final maps. The two operations are in direct opposition in the matter of scale. The higher a plane flies, the less stereoscopic models need be handled to cover an area with contours by Multiplex or KEK plotter. The higher the flights, the wider must be the contour interval and the less detail can be discerned by the photo-geologist. Obviously a happy medium must be found. Since it is the height of photography and not the focal length of the camera that determines the accuracy of a chosen contour interval, and the height of photography coupled with focal length controls scale which in turn controls the amount of detail visible in photographs of an area, a short focal length camera flown at a medium height generally satisfies the requirements of both the photo-topographer and the photo-geologist.

For Multiplex contouring at 10-foot contour intervals, a flight height of 10,000 feet is recommended with either six- or 12-inch lens. Use of the six-inch lens, however, results in processing approximately one fourth the number of stereoscopic models necessary to cover the same area with 12-inch lens, even though the 12-inch lens gives double the scale, a desirable feature for the photo-geologist. Work on the plateau area of Naval Petroleum Reserve No. 4 in Alaska, where geologic features are distinct, proved that excellent interpretation could be done on photographs with a scale of 1:24,000 (1 inch to 2000 feet). Melton maintains that 1:20,000 is too small a scale for geologic interpretation and his observation is no doubt correct for many areas ([105]Melton—1945). The height of photography may be controlled by the types of terrain which the photo-geologist must interpret. Six-inch focal length photographs flown at 7500 feet provide a large enough scale for accurate interpretation of most areas by the photo-geologist. Smaller areas of intense study at this scale have a minimum of stereo-models, hence a reduction in the time-consuming instrumental work by the photogrammetrist. If contouring is not needed and the photo-geologist is a capable KEK or Multiplex operator, much time can be saved by spot elevation work on geologic contacts for construction of structural maps, a process which does not require complete topographic contouring of the area.

Final Geologic Interpretation

The aim of much reconnaissance in oil exploration is production of geologic maps to guide the planning of a drilling campaign. If a concession is amenable to geologic interrpetation as a whole or in part, those parts should be photographed at a scale which will yield fine detail in the aerial prints and the areas should be contoured at a small contour interval. Final geologic interpretation results in the plotting of structural axes, attitude of beds, faults, joint systems, plus structural contouring from photographic key beds, and construction of structural cross sections. Some of these data may be gained with a minimum of field examination over many areas, but the final interpretation must be done in the field by checking the stratigraphic sections and faulted or strongly folded areas.

Photogrammetric Maps for the Geophysicist

Newer techniques in photogrammetry have made available to the geophysicist, photogrammetric maps which are of great aid in field surveying. If precise large-scale vertical photography is made available over areas to be covered by seismograph or gravity meter and controlled planimetric maps or mosaics compiled from these photographs are furnished field crews, shot points and instrument locations can be spotted directly with a geographic accuracy as great as that gained in traversing or third-order triangulation with the transit. The Brock and Weymouth process is a photogrammetric technique with which contour maps of any desired contour interval may be compiled ([1]P533, 1944). One-foot contour maps with an accuracy of plus or minus one half foot have been completed at large scales. The process, which requires vertical ground control accurate to one tenth the desired contour interval, could be adapted to the closure of photogrammetric traverses at an accuracy necessary in the field surveying of ground elevations for gravimetric, magnetometric, and seismic surveying. The scale of maps so constructed would, however, be very large and complete contouring of a seismically surveyed area may be economically prohibitive unless a rapid laboratory procedure could be devised for photogrammetric computation of shot point and instrument elevations without contouring the whole area.

TRANSPARENT MODEL OF RESERVOIR SHOWING DISPLACEMENT OF OIL BY CONJOINT USE OF GAS AND WATER

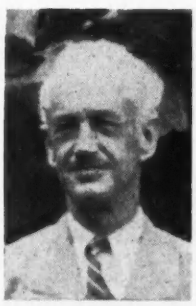
By FREDERICK SQUIRES

SIMULTANEOUS INJECTION of gas and water into an oil reservoir as a means of maintaining initial pressure and production rate throughout the life of an oil pool is explained and illustrated by means of a model oil reservoir. By injecting gas into the cap and water into the water table the water-oil and oil-gas interfaces remain horizontal and the injection procedure results in a steady displacement of oil with less fingering or channeling, assuring maximum oil recovery from the reservoir.

IN MOST oil-bearing structures, gas, oil and water are under pressure, and except for dissolved gas and connate water, are arranged in nearly horizontal layers according to their respective specific gravities. When wells are drilled into such an oil-bearing reservoir, the oil flows because of the differential pressure between the reservoir and the earth's surface. The outflow of oil and gas lowers the pressure in the drilled area, and this sets up an inward motion of the surrounding fluids toward the well bore. Reservoir pressures can be maintained only when there is sufficient inflow from an outside source through sufficiently permeable intervening sand to equal the outflow of gas and oil from the wells. Under all other conditions the reservoir pressure constantly decreases. This is true whether the pressure is due to diminishing static head or to expansion of the impounded fluids. Production rate decreases as the pressure declines.

The rate of flow of oil depends on pressure differential. Whenever the differential is not enough to raise oil to the surface, the flow stops. Wells then must be pumped, and eventually the pressures become so weak that they move little or no oil to the wells.

The diminution of the volume of oil produced bears a fairly close relationship to the pressure decline, yet the pressure decline is not proportional to the volume of oil remaining in the sand; for while the pressure differential is falling from maximum to zero, the volume of oil in the reservoir falls from maximum to a substantial fraction of the original amount. It is therefore important, both in quantity of oil produced



About the Author

FREDERICK SQUIRES, petroleum engineer for the Illinois State Geological Survey, is credited with the first successful applications of repressuring and intentional water flooding in the Illinois oil fields. He holds degrees from Williams College and the School of Mines of Columbia University. He formerly was partner and field manager of Squires Brothers, Remlik Oil Company and Dinsmor Oil Company, which were organized at the inception of secondary recovery. At present he is chairman of the Illinois - Indiana - Kentucky Section of the Eastern District Standing Sub-Committee on Secondary Recovery Methods, API. He has invented several oil field processes and has contributed a number of technical papers on petroleum engineering.

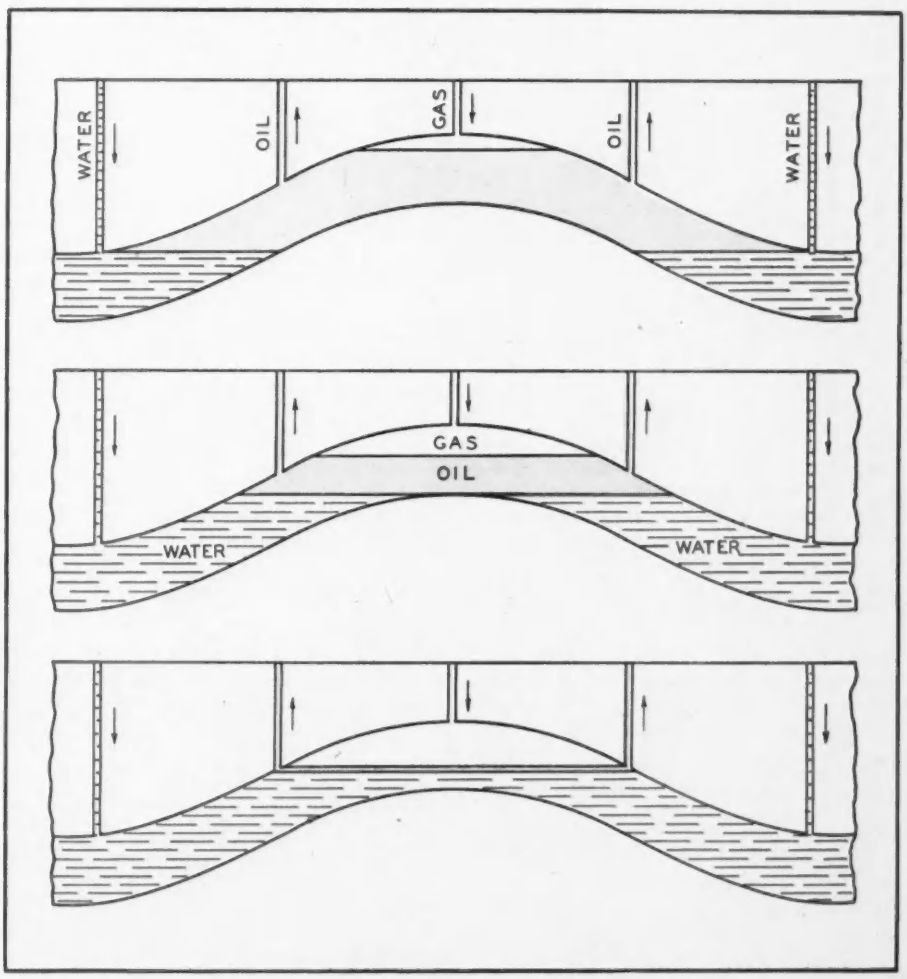


Figure 1. The uppermost section shows the earliest phase of conjoint use. The middle section shows the increase in the areas of water and gas and the corresponding decrease in oil area. The lowest section shows the completion of the process wherein water and gas have almost entirely displaced the oil at the oil producing wells.

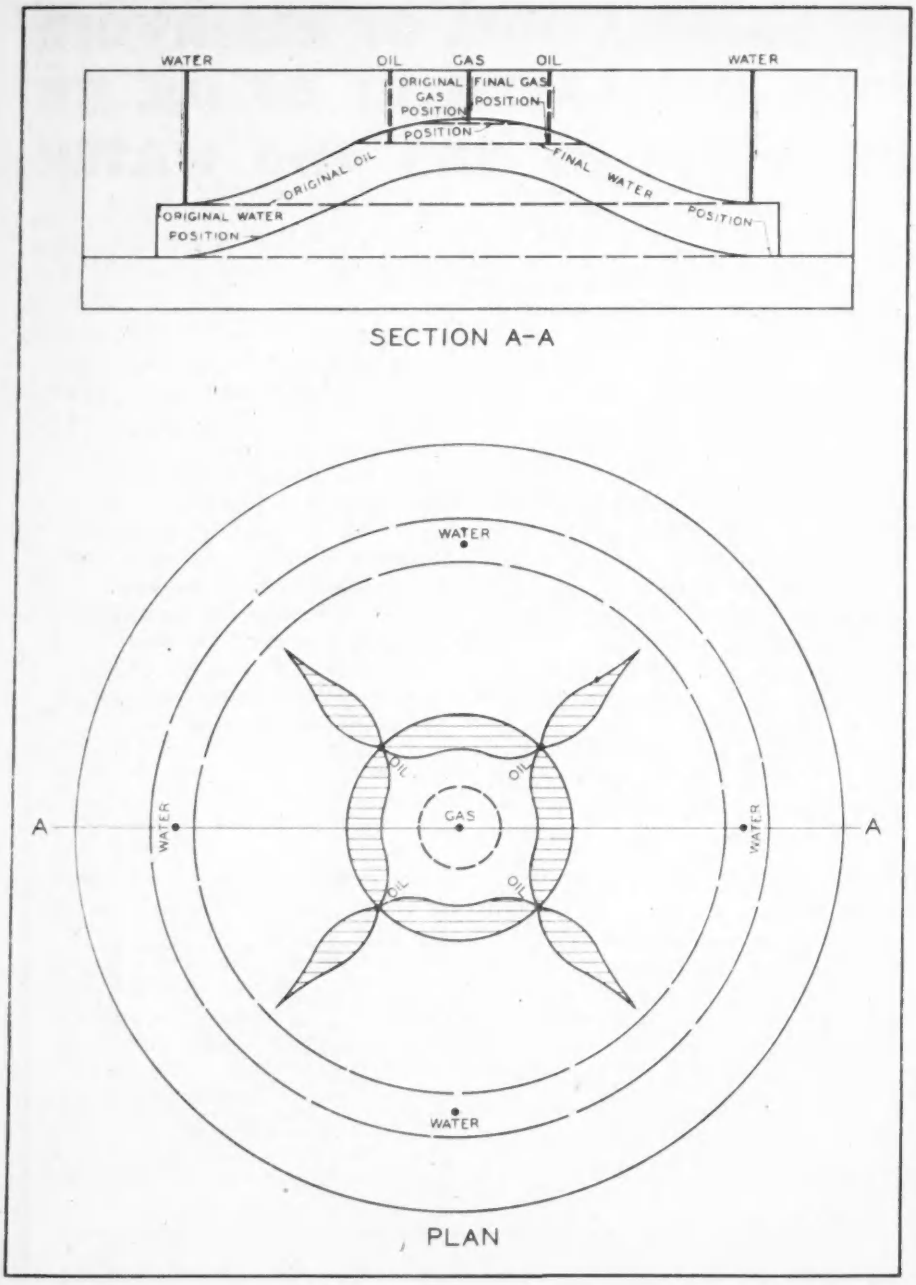


Fig. 2. Section and plan of the model showing the form of the sand body (a dome) and the positions of gas, oil, and water wells. The shaded areas on the plan show that under high pressures oil is being produced mixed with gas or water. Blank areas in the plan indicate that no mixing of oil with gas or water has taken place. The section shows the positions of water and gas both (1) before injection and (2) their positions at the completion of the displacement operation.

and brevity of time required, to find efficient means to maintain high reservoir pressure. This may be accomplished by continuously maintaining the original reservoir pressure by artificial means, which has been attempted in two ways: (1) by injecting gas alone; and (2) by injecting water alone. Actually, there would be a greater advantage in injecting both at the same time, each in the right place.

In virgin reservoirs, the three fluids have followed the laws of gravity in their stratification. Were they rearranged in any different way, in time each would again find its own level. To do so the lighter fluid would have to pass through the heavier. Such a case might be illustrated by the upwarping of a syncline into an anticline, in which circumstance the water at the bottom would be raised to the top and the gas would find itself below the oil. This would cause movement and readjustmen according to gravity.

Such a readjustment may be brought about by artificial means. If gas were injected into the top and bottom of an oil-containing structure, the gas in the bottom would make its way to the top through the water and oil. If water were injected into the top and bottom of the structure, the water in the top would make its way to the bottom. In each case part of the fluid would be passing through oil in order to reach its own level. On the other hand, if gas were injected into the top and water into the bottom, there would be no change in stratification. The result would be to keep the water-oil and oil-gas interfaces horizontal, and to squeeze the oil by increasing the pressure above and below it (Figure 1).

In field production this method would not always be practical but would lend itself best to high-gravity oil, high-porosity sands, and steep structure with edge water and gas cap. Some McClosky pools, the Johnsonville for example, have most of these characteristics.

The Transparent Model

It is very difficult to picture the underground reactions of gas, oil, and water because they are not visible, but it is easy to make a transparent model of an oil field and see what goes on in it, under selected conditions. The problem is of course oversimplified in a model, and results are not directly comparable to field conditions, yet such a study is useful in analyzing oil field problems.

A plan and section of a simplified oil structure and the surrounding strata was drawn, from which a wooden model was built. Several different arrangements of input and producing wells were considered for use in a transparent model and the one adopted is illustrated in Figure 2.

The plan presented in Figure 2 shows gas, oil and water wells located so that oil may be displaced downward by gas and upward by water, keeping the gas-oil contact and water-oil contact horizontal. If gas and water are injected at the proper rates, these two contacts will come together at the level of the bottom of the oil well when the last of the oil has been produced. Because of the high gravity of the oil, the high permeability of the sand, and the steepness of the structure, this was easy to accomplish in the model. It is, of course, impossible to reproduce these conditions exactly in actual production from the average oil-bearing structure because the contact

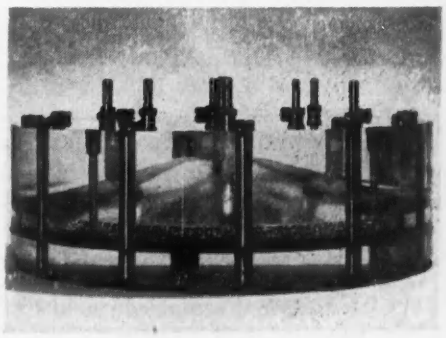


Figure 3. View from the side, showing the transparent model. The structure is evident as well as the glass beads representing the sand.

Published by permission of the Chief, Illinois State Geological Survey.

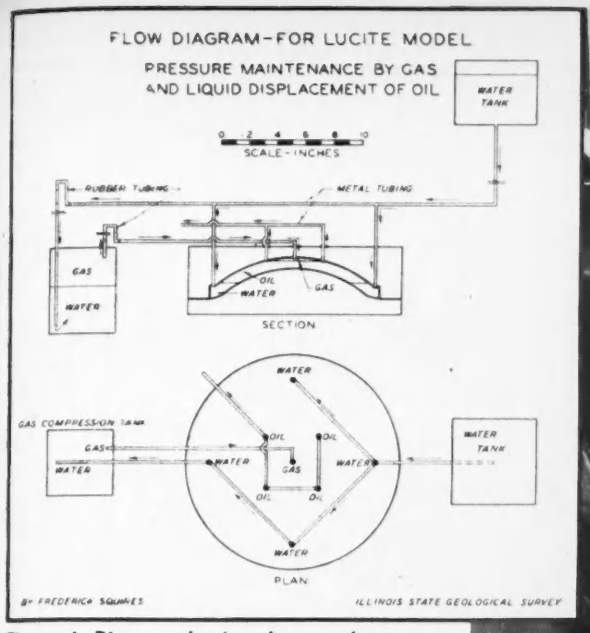


Figure 4. Diagram showing the way the transparent model is equipped to perform the displacement operation. The elevated water tank on the right furnishes the hydrostatic head which produces the displacement gas and water pressures. Water pressure is applied directly to the water input wells. Gas is compressed in the closed tank at the left by means of the static water pressure and conducted thence to the gas input well. The degree of gas pressure with relation to water pressure may be changed by raising or lowering the closed tank.

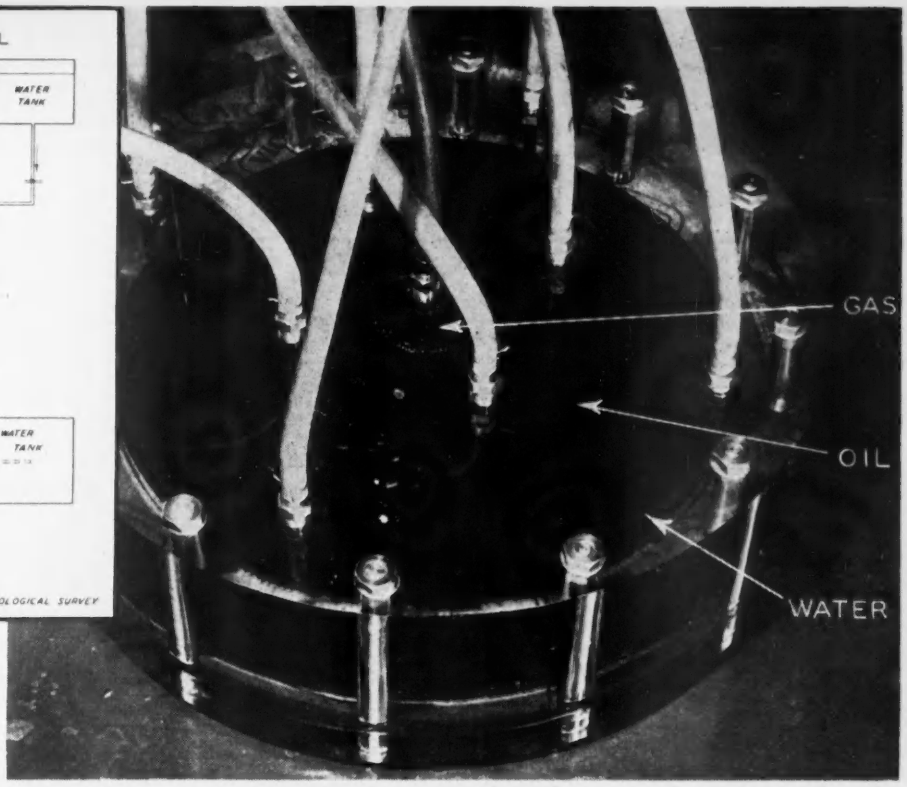
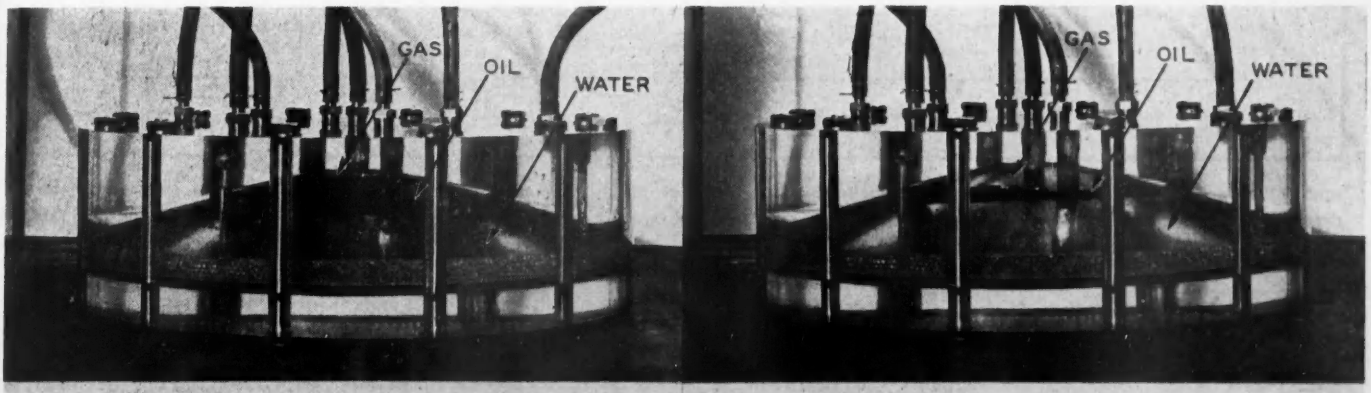


Figure 5. This shows the sand almost full of oil but with gas cap at the top of the structure and water at the extreme lower and outer edge.



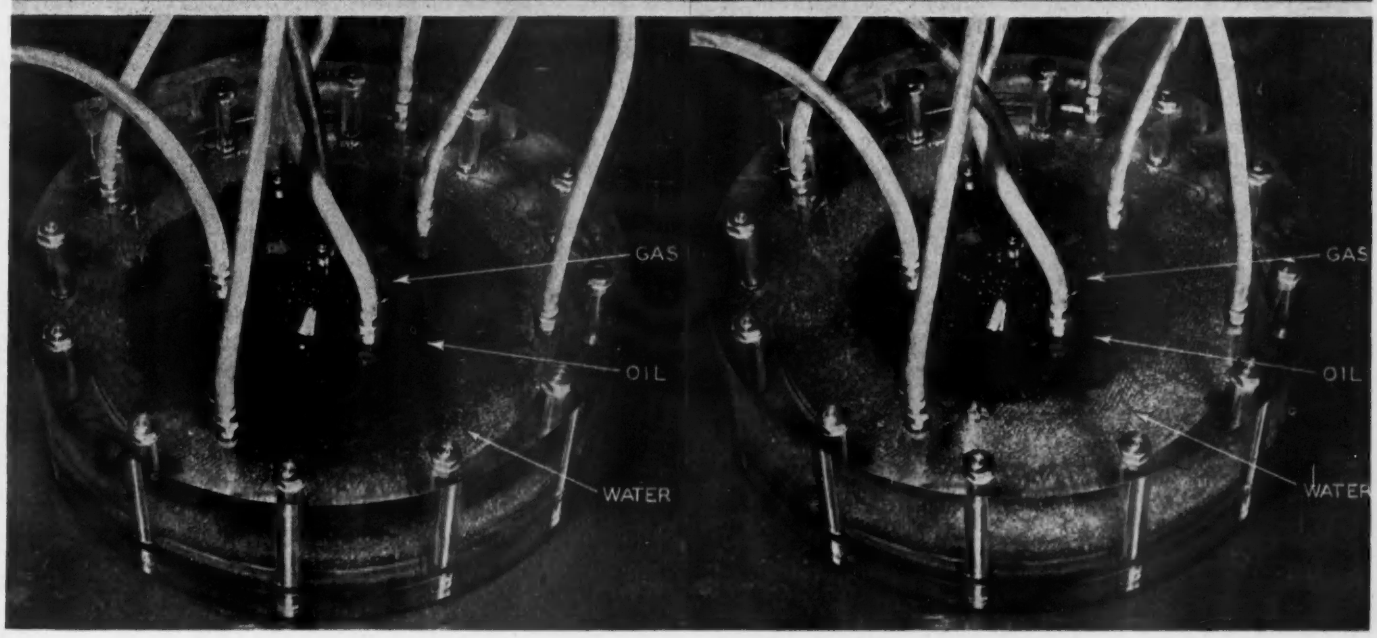


Figure 6. These are two views of the squeeze—the gas cap and water edge having been enlarged and part of the oil vented.

Figure 7. This shows a later phase of the squeeze wherein both gas cap and water boundary have enlarged and the oil is in the immediate area of the oil wells.

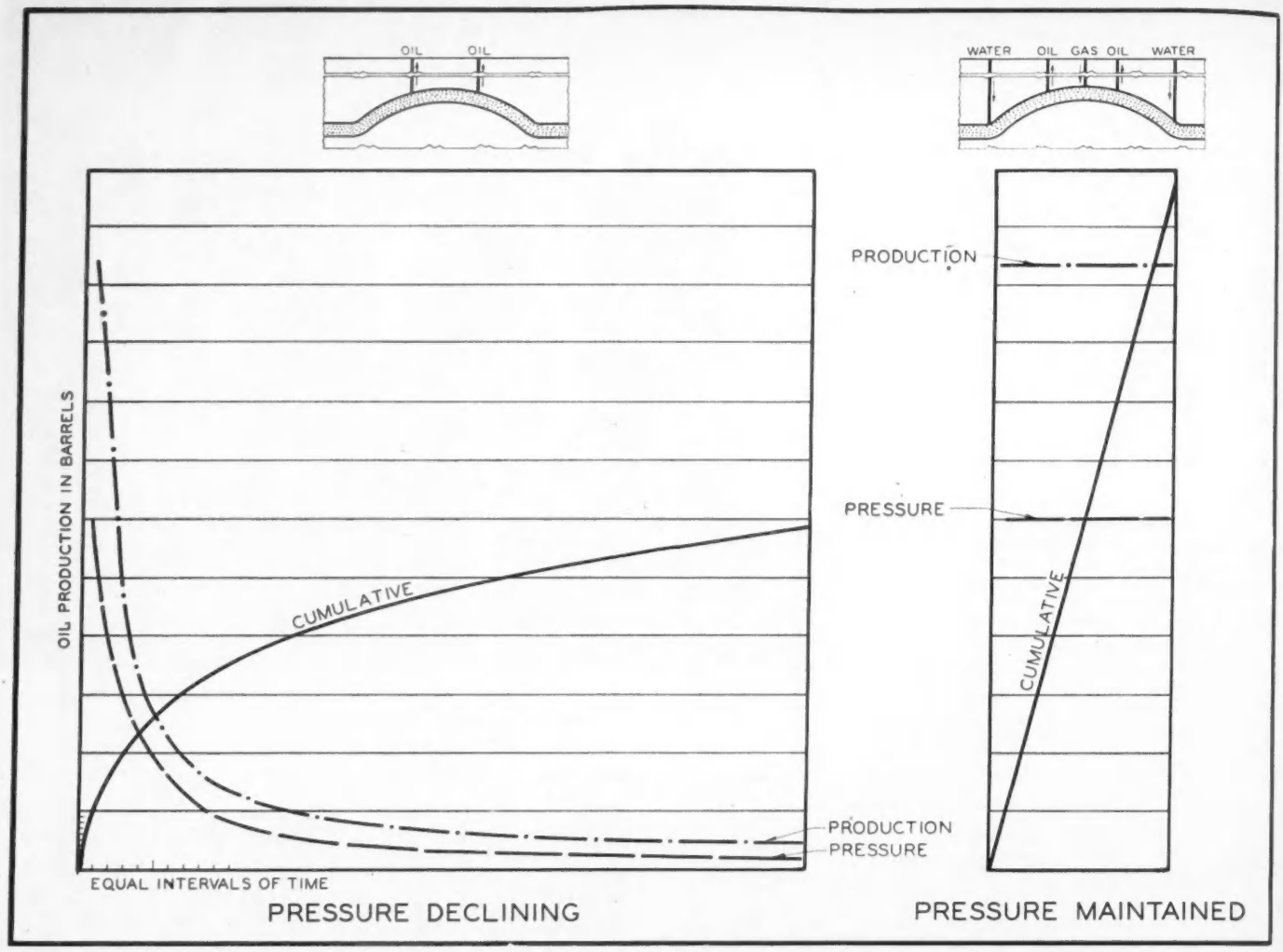


Figure 8. These two graphs show by contrast with each other the difference in results in amount of oil production and time required of (1) open natural flow with declining pressure; and (2) maintained production with artificially maintained reservoir pressure. (It is assumed that the ultimate oil production by natural pressure will be one-half that obtained by maintained conjoint pressure since the latter combines primary and secondary results.)

planes between the different liquids are never perfectly horizontal but are warped and dip toward the producing wells.

After the plan shown in Figure 2 was chosen, the transparent plastic model shown in Figure 3 was made and drilled to comply with it. The model was then connected up to the pressure sources as shown diagrammatically in Figure 4.

The operation is shown by Figures 5, 6 and 7, which illustrate the progress of the venting of oil by the introduction of water at the lowest part of the dome, gas at the highest part, and the withdrawal of oil from the intervening oil wells. Figure 5 shows the sand practically full of oil, with only a narrow circumference of water, and a very small gas cap. Figures 6 and 7 show progress of water updip and gas downdip, resulting in a diminishing area of oil between. The views taken from the side in these figures show the stratification of the three fluids. With low pressures there was no "fingering" or channeling of the gas or water direct to the oil well, but when pressures were raised, fingering occurred. It followed quite closely the fingering shown diagrammatically in Figure 2. When fingering begins, the method changes from displacement to gas drive and/or water drive, a condition that should be avoided as long as possible. This can be retarded by using long distances between unlike wells and short distances between like wells. (Like wells means (1) gas input wells, or (2) water input wells, or (3) oil-producing wells.) A glance at the pattern of fingering shown on the drawing, Figure 2, explains the reasons for this method of well spacing. When fingering from either gas or water begins, it can be stopped or retarded by lowering the pressure on the input wells which produce it.

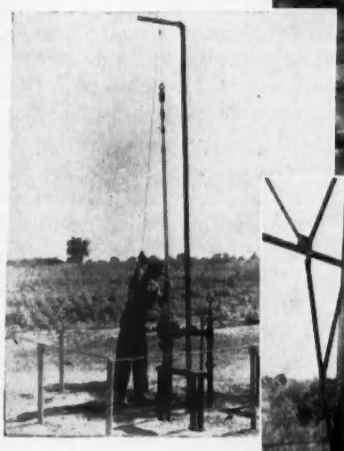
The available volumes of the pressure media, air and water, are limitless. Their conjoint use conserves the gas which would have been wasted in a waterflood and takes care of salt water disposal. It greatly reduces distances and time as compared with either of the single injection methods. The need for improvement in production methods is driven home by the startling differences between the two oil-production graphs, one showing history in time and volume under pressure decline, and the second showing the history of the same well when constant pressure is maintained by conjoint injection of gas and liquid (Figure 8).

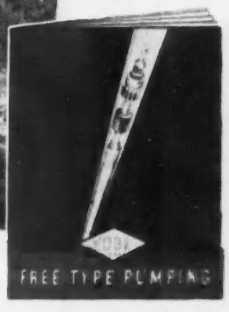
Petroleum engineers will do well to consider the conjoint use of gas and water for oil production as a means of continuing initial pressure and production rate throughout the life of an oil pool.

Acknowledgments

The author wishes to thank A. H. Bell, Paul G. Luckhardt, Parke A. Dickey, A. W. Gotstein, Walter Squires and E. S. Merriam for help on the problem.

Changing the **Free Pump*** *is a one-man job!*





*KOBE *FREE PUMP** *is an adaptation of conventional Kobe Hydraulic Pumping. "Free" refers to the fact that it is not suspended in the well at the end of rods or tubing. It is raised and lowered in the well tubing, hydraulically.*

. . . it surfaces and seats hydraulically

Turn of a wellhead valve is all that is needed to retrieve or run the Kobe Free Pump. It can be lifted from the well by one man, and round-tripped from 5,000 feet in less than two hours.

Free Pumping eliminates pump pulling, servicing equipment and costly downtime. This means a saving of 25% or more in your pumping operating costs.

Replacing or repairing the bottom hole pump no longer need involve the added expense of pulling and running. Changing pumps to meet changing oil conditions can now be determined solely on the desirability of the change.

Investigate the saving you can make by converting to Free Type Pumping. Your local Kobe representative will be glad to arrange a demonstration of Free Pumping in a nearby well.

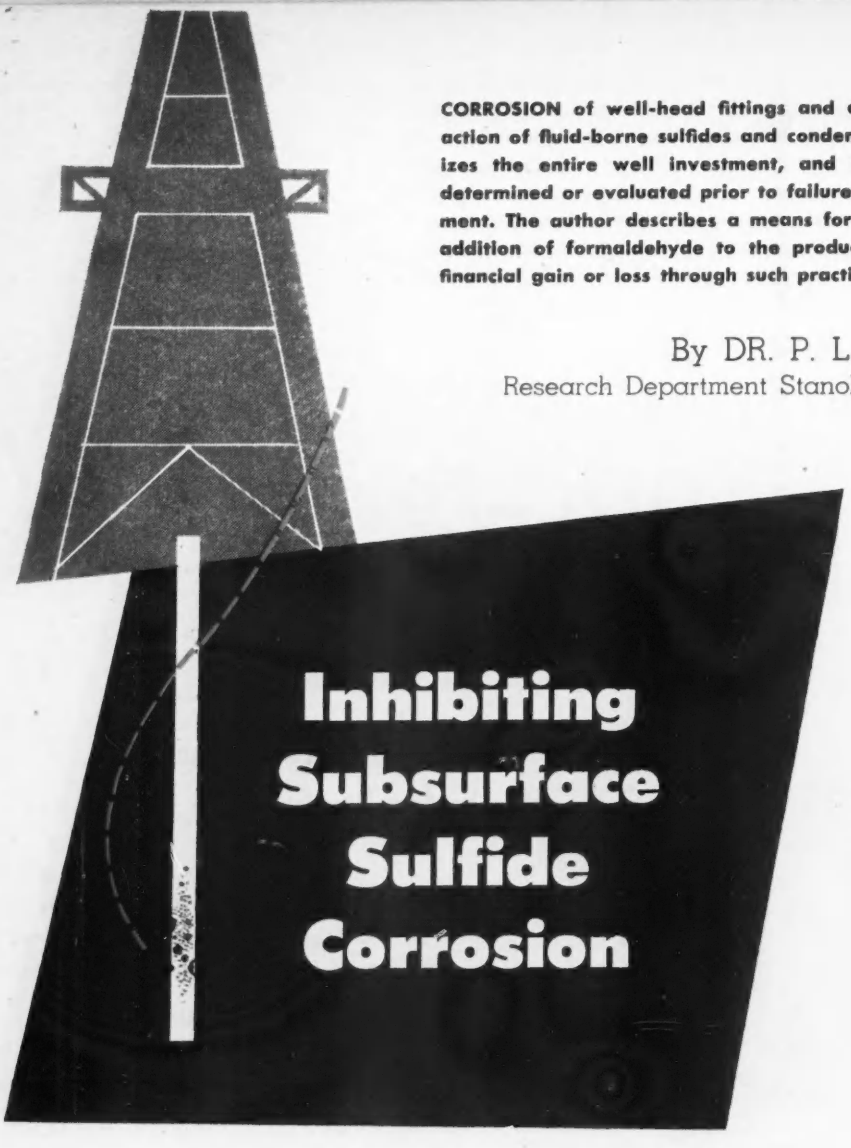
Write for Booklet—To learn how the Kobe Free Pump can reduce your pumping costs, write for the booklet, "Free Type Pumping." It will be forwarded without obligation.

KOBE

ONE OF THE DRESSER INDUSTRIES

KOBE, INC., General Offices: Huntington Park, Calif. *Division and District Offices:* Bakersfield, Ventura and Huntington Park, Calif.; Vernal, Utah; Oklahoma City and Tulsa, Okla.; Brownfield, Dallas, Houston, Longview, Odessa and Wichita Falls, Texas; Natches, Miss.; Great Bend, Kansas; New York City, N. Y.

GREATEST ADVANCEMENT IN OIL FIELD PRACTICE SINCE ROTARY DRILLING



Inhibiting Subsurface Sulfide Corrosion

CORROSION of well-head fittings and down-the-hole equipment through the action of fluid-borne sulfides and condensed water within the system jeopardizes the entire well investment, and is often a trouble which cannot be determined or evaluated prior to failure of some important part of the equipment. The author describes a means for inhibiting such corrosion through the addition of formaldehyde to the production stream, cited field examples of financial gain or loss through such practice.

By DR. P. L. MENAUL
Research Department Stanolind Oil & Gas Company

"THE Billion Dollar Side Show" referred to by H. H. Anderson,[1] of the Shell Pipeline Corporation with reference to the needless annual loss caused by pipe line corrosion is even more pertinent to subsurface corrosion of oil well equipment where repair is difficult and expensive.

The economic loss incurred by corrosion of subsurface oil well equipment is such an important factor in the operation of many oil fields that any method of reducing this loss claims the interest of all oil operators. The corrosion of subsurface equipment may result in:

1. The cost of new equipment
2. The labor cost of replacing the equipment
3. The cost of repair or workover job, i.e., employment of a well service company for cementing, etc.
4. A permanent loss of valuable oil or gas production
5. Possible damage to the producing reservoir
6. Loss of production during the workover operation.

The overall grouping of corrosive agents that may affect subsurface equipment includes:

1. Acid
2. Sulfide
3. Hydrogen embrittlement
4. Electrolytic
5. Galvanic
6. Concentration cell

If two or more corrosive agents, such as both sulfide and electrolytic, are active on the same piece of equipment the effect then is much intensified over the sum of the damage caused by each corrosive agent acting separately. The sulfide damage to rods and tubing may be mild and the electrolytic action due to low-flow line currents may be mild, yet if the two agents are present the damage will be severe. This also is true of the action of sulfide corrosion and the galvanic action set up between the iron sulfide scale and metallic iron. This latter combination of corrosive agents has resulted in casing perforations in West Texas and New Mexico.

It is evident that the severity of corrosive attack is due to factors which influence the rates of chemical processes and is governed by the kinetics of chemistry and electrochemistry. Its mitigation involves the service of the corrosion chemist.

Sulfide corrosion of subsurface equipment is as extensive as the areas producing sour crude. These areas include the major fields of Arkansas, West Texas, New Mexico and western Kansas. Sulfide corrosion is active in acidic and neutral solutions. Water is necessary for corrosion and it is assumed that wells producing sour oil or gas will not be affected by corrosion until the appearance of water in the production. However, it has been found that moisture will condense from the gas in the casing annulus and free water will break out of the oil during shutdown time. Consequently, sulfide corrosion may be well under way on the well equipment before the appearance of free water in the production.

In the presence of moisture, hydrogen sulfide attacks steel to form ferrous sul-

ABOUT THE AUTHOR

Menaul was born in Albuquerque, N. Mex., and studied at the universities of New Mexico and Illinois, obtaining B.A. and M.S. degrees in chemistry. He was chemist at the State Experiment Station at Oklahoma A. & M. College from 1920-30 and then joined Halliburton Oil Well Cementing Company as chemist. There he originated and developed penetrating and non-emulsifying acids and methods of inhibiting corrosion. He joined Stanolind Oil & Gas Company's research department in 1942.

Figure 1 — Pump rod disjuncture.

fide and free hydrogen. The hydrogen may penetrate into the metal, especially under metal stress as in pump rods, causing hydrogen embrittlement which results in the smooth plane breakage so often observed, Figure 1. Here we have a two-fold damage caused by hydrogen sulfide, the corrosion of metal and damage to the remaining metal by hydrogen embrittlement which may cause rod failure to occur after as little as 35 days of operation.

Tubing Damage

Tubing is corroded from the inside by the free sulfide brines produced with the oil. This action may be so severe as to cause perforation of tubing in eight months. Brines that are produced emulsified in the oil, would not contact or wet the tubing, but brines will break out during shutdown time with resulting damage to tubing and rods. The outside of the tubing in the gas space is corroded by moisture condensing from the gas and the hydrogen sulfide present. Droplets of moisture will condense on the inside of the casing and outside of the tubing from the sour gas in the annulus between tubing and casing, forming a corrosive solution with the hydrogen sulfide of the gas. If there is no flow of production to spread these condensed water droplets, corrosion will continue in these localized spots. This sulfide corrosion is intensified by the galvanic action between the iron sulfide scale produced and the metallic iron of the casing and perforation is rapid. This type of damage is prevalent in West Texas and New Mexico where much casing has been perforated (Figure 2.) The repair of damaged casing involves either a string of new casing or many expensive squeeze cementing jobs.

The pumps used in areas producing sour brines suffer from sulfide corrosion which is often aggravated by the galvanic action of dissimilar metals used in the various pump parts.

There is no certainty as to when attack by sulfide corrosion will begin during the life of a well, even though no water is produced at first. There is no method of detecting sulfide corrosion except inspection of the equipment which will involve considerable expense, or may be impossible. It seems advisable then to treat all wells producing sour oil as soon as they are put on production.

The operating costs of some fields has been so increased by sulfide corrosion of equipment that continued production was not economical, and wells were abandoned while producing considerable oil.

Equipment made of corrosion-resistant alloys was not economical; paints, coatings and galvanizing failed to give protection. Commercial inhibitors and alkalies were found ineffective in preventing sulfide corrosion.

The study of sulfide corrosion and methods of inhibiting this action was one of the first problems dealing with corrosion control undertaken at the Research Laboratory of Stanolind Oil & Gas Company at Tulsa. This work resulted in the discovery that water-soluble aldehydes, such as formaldehyde, are effective inhibitors of sulfide corrosion. The research and field trials of the newly discovered action of formaldehyde have been reported in previous articles.[2,3]

Treating wells producing sulfide brines with formaldehyde to inhibit sulfide corrosion has been carried on for three years and outstanding results of savings in operating costs and maintenance of equipment have been obtained.

Methods

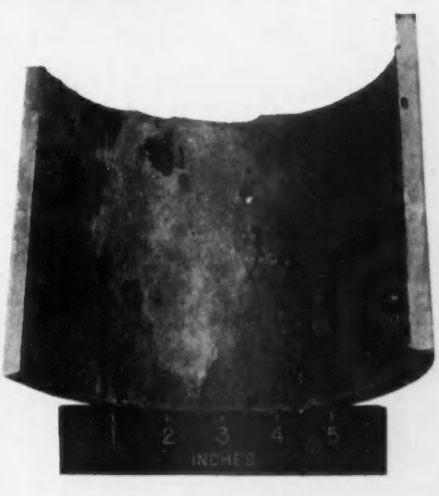
Although technical supervision is strongly recommended in order to obtain maximum benefits from the formaldehyde treatment, it should not be concluded that the treatment is so difficult as to require a large amount of technical supervision or that it cannot be used to any advantage without technical assistance. Improper use of formaldehyde cannot cause any loss beyond the cost of injected chemical; consequently, significant savings are possible without technical supervision in known sour crude areas by following the general procedure of insulating all wells from flow-line currents and treating all wells producing water with formaldehyde in the proportions of 1 quart of formaldehyde per 50 barrels of produced water. In view of the small amount of time involved in making necessary chemical analyses and inspections of wells to insure optimum use of formaldehyde, the following method of applying formaldehyde is recommended:

On initiating the formaldehyde treatment, the well is first surveyed by the corrosion chemist; the well is insulated from flow line currents, scale is removed from well equipment; the equipment is put in condition for continued operation; the produced water is analyzed; the amount of formaldehyde to use daily is determined; and the type of injection chosen. After treating the well for a few days the formaldehyde content of the effluent water should preferably be checked to determine that the chemical is circulating, and subsquent periodic checks are advisable.

The injection of formaldehyde as practiced has been by batch treating down the annulus, the daily dosage of chemical being introduced at one time, and continuous injection, the daily dosage being greatly diluted with water or well production and slowly injected during the 24 hours. The method of injection employed is at the judgment of the corrosion chemist, depending upon the height of liquid in the annulus, production characteristics of the well, etc.

When the inhibting action of formaldehyde first was announced, the treatment was applied to sulfide wells which also were affected by electrolytic currents, galvanic currents and even

Figure 2 — Casing Corrosion, Hobbs field, New Mexico.



oxygen corrosion through open casing. Formaldehyde treatment also was applied to wells whose equipment was no longer serviceable and covered with iron sulfide scale which continued its galvanic action on the metal underneath. In such cases the action of formaldehyde did not prevent the continued action of these other forms of corrosion.

Positive results were obtained when the corrosion chemist determined the corrosive agents affecting the wells, resulting in the remedial measures eliminating the flow-line currents, galvanic action of dissimilar metals and scale, etc., then determining the damage due to sulfide. The injection of formaldehyde then reduced corrosion damage to an insignificant factor.

Field Results

Early field trials in the Yates area of West Texas proved that balls and seats still were in good condition after five months' operation with formaldehyde injection, compared with only 20 days' service without formaldehyde treating. The service of tubing and rods was likewise extended. Repair costs were reduced 75 percent. Shallow wells in this area show a reduction in operating costs of $275 per well per year for the wells treated.

In Ector County, Texas, a well having a record of ten rod failures per year, seven pump failures per year, and three tubing failures per year has been treated with formaldehyde for one year without a rod, pump or tubing failure. The well has not been pulled during the year of formaldehyde treatment.

Stanolind Oil & Gas Company has been treating more than 200 wells in the Kansas area for two years and the records show a large saving in operating costs. Some wells could not be operated without the saving due to formaldehyde treatment. Formaldehyde treatment of wells in the Ellinwood area for 19.5 months showed an average saving of $725 per year per well.

A field operation report of equipment failures when 32 wells were treated for 14 months with formaldehyde as compared with a similar period before treatment is given in Table 1.

TABLE 1

Equipment Failures Before and During Formaldehyde Treatment, Ellinwood, Kansas.

	Before Formaldehyde Treatment	During Formaldehyde Treatment
Rods	238	105
Tubing	133	47
Pumps	56	39

Some failures during treatment were due to corrosion damage to old equipment, initiated before treatment was begun.

Five sulfide-producing wells in Wyoming have been treated with formaldehyde for one year and operating costs show a reduction of $520 per well per year. The saving in material and pulling expenses is clearly shown. Material benefits exist also in the sour gas collecting system into which formaldehyde is injected. The continued use of the old equipment beyond the previous life estimates is one of the benefits attributed to the use of formaldehyde.

Repair Costs

A tabulation of the repair costs, of 77 wells in Kansas and 17 wells in West Texas for which sufficient data are available of the cost per year previous to and during the formaldehyde treatment, is given in Table 2.

For the Kansas area, there was a total saving on 77 wells of $51,927 per year or an average saving of $674 per well per year during the period of formaldehyde treating. The cost of repairs done on these wells was reduced to less than half the cost prior to treating, or from $94,956 per year prior to treating to $43,029 per year, including the cost of formaldehyde.

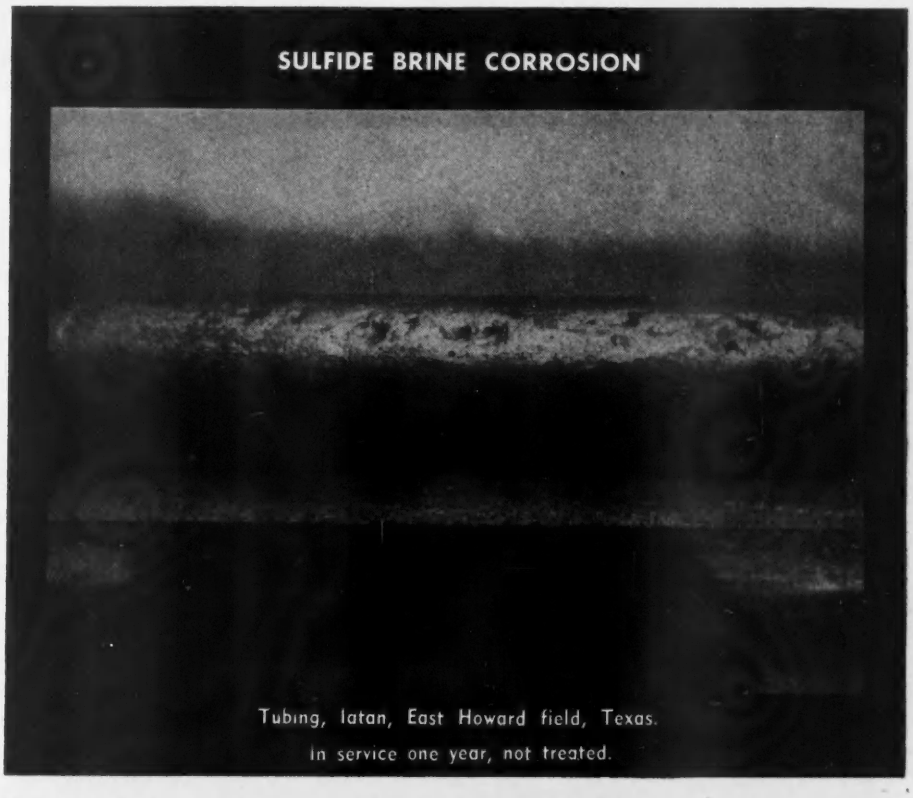
A more remarkable fact is brought in Table 2 in the record of field No. 14 in the Zenith area. These five wells show an annual upkeep of $69 per well,

TABLE 2

Cost Data on Formaldehyde Injection—Summary By Fields

AREA	Field No.	No. Wells Reported	Average Months of Treatment	TOTAL COST		TOTAL SAVING OR LOSS		COST PER WELL PER YEAR		SAVING OR LOSS PER WELL-YEAR	
				Before	After*	Saving	Loss	Before	After*	Saving	Loss
Ellinwood	1	1	21.5	$ 2,888	$ 3,325	.....	$ 437	$ 2,888	$ 3,325	.....	$ 437
	2	1	20.5	1,445	1,392	53	....	1,445	1,392	$ 53	....
	3	1	20.5	2,058	1,178	880	....	2,058	1,178	880	....
	4	4	20.1	580	907	.....	327	145	227	.....	82
	5	1	21.0	135	182	.....	47	135	182	.....	47
	6	26	18.6	33,791	20,407	13,384	....	1,300	785	515	....
	7	9	20.1	19,142	4,528	14,614	....	2,127	503	1,624	....
	8	10	20.8	16,220	5,934	10,286	....	1,622	593	1,029	....
Totals	..	53	19.5	$76,259	$37,853	$38,406 Net	....	$ 1,439†	$ 714†	$ 725 Net	....
Gorham	9	4	19.8	$ 4,242	$ 1,136	$ 3,106	....	$ 1,061	$ 285	$ 776	....
	10	1	20.7	1,288	1,155	73	....	1,228	1,155	73	....
	..	5	20.0	$ 5,470	$ 2,291	$ 3,179 Net	....	$ 1,094†	$ 458†	$ 636 Net	....
Zenith	11	2	8.0	$ 558	$ 97	$ 461	....	$ 279	$ 49	$ 231	....
	12	6	15.0	3,543	1,197	2,346	....	591	199	392	....
	13	3	8.0	7,076	1,107	5,969	....	2,359	369	1,990	....
	14	5	15.5	195	343	.....	$ 148	39	69	.....	$ 30
	15	3	5.0	1,855	141	1,714	....	618	47	571	....
Totals	..	19	11.7	$ 13,227	$ 2,885	$10,342 Net	....	$ 696†	$ 152†	$ 544 Net	....
Kansas Totals	..	77	17.7	$ 94,956	$43,029	$51,927 Net	....	$ 1,233†	$ 559†	$ 674 Net	....
Yates	16	2	22.0	$ 2,252	$ 497	$ 1,755	....	$ 1,126	$ 249	$ 877	....
	17	1	13.0	1,835	2,409	.....	$ 574	1,835	2,409	.....	$ 574
	18	8	20.9	4,915	4,280	635	....	614	535	79	....
Totals	..	11	20.4	$ 9,002	$ 7,186	$ 1,816 Net	....	$ 818†	$ 653†	$ 165 Net	....
Hendrick	19	6	21.2	$ 14,530	$ 8,948	$ 5,582 Net	....	$ 2,422†	$ 1,491†	$ 931 Net	....
Texas Totals	..	17	20.6	$ 23,532	$16,134	$ 7,398 Net	....	$ 1,384†	$ 949†	$ 435 Net	....
Total for all Kansas and Texas Area‡	..	94	18.2	$118,488	$59,163	$59,325 Net	....	$ 1,261†	$ 629	$ 632 Net	....

* Including cost of formaldehyde.
† Weighted; that is, equal to the total cost, divided by total wells.
‡ Excludes one field in which formaldehyde has not been found in the effluent water from a majority of the wells.



Tubing, Iatan, East Howard field, Texas.
In service one year, not treated.

Tubing, Iatan, East Howard field, Texas.
In service one year, formaldehyde treated.

including the cost of formaldehyde, while the upkeep costs of wells in fields No. 12 and 13 are $199 and $369, respectively, per well per year during formaldehyde treating. The reason for the unusually good showing in field No. 14 is that the formaldehyde treatment was begun on these wells shortly after their completion and before sulfide corrosion had damaged the well equipment. These other wells, in the Zenith area, had been produced for several years before formaldehyde treatment was begun and the well equipment had been damaged by sulfide corrosion. This brings out the importance of treating all wells drilled into sour or sulfide production, with formaldehyde as soon as the wells are put on production.

Another important factor was disclosed during field surveys. A few wells were found that did not respond satisfactorily to the formaldehyde treating. By testing the effluent water it was found that no formaldehyde was present. In wells where corrosion damage had been satisfactorily reduced, the formaldehyde, one to ten parts per million, was found in the effluent water.

In regard to Table 2 the procedure was arbitrarily followed of comparing well costs over equal time intervals before and after starting formaldehyde treatment. This method resulted in showing losses for some fields (see Table 2). It has been proven that the formaldehyde treatment cannot increase corrosion and consequently the only true loss which can have occurred in Fields 1, 4, 5 and 17 through use of formaldehyde is the cost of formaldehyde used. The main reason for losses being shown in those wells in which formaldehyde did not circulate from the well annulus into the production stream and consequently did not inhibit corrosion is the fact that sulfide corrosion when uninhibited shows a natural progressive increase in severity.

Conclusions

The corrosion of subsurface well equipment by sulfide can be almost entirely prevented by the daily injection of formaldehyde into the annulus of such wells. Wells where sulfide corrosion damage prevents economic operation may now be operated at a profit.

The field operations should first include a field survey of the wells by the corrosion chemist.

Remedial measures must be taken for all corrosive agents, and the equipment conditioned for continued operation.

Treating wells affected by sulfide corrosion with formaldehyde results in an important net saving in operating costs.

The effluent water from treated wells should preferably be checked periodically by the corrosion chemist to ascertain that the formaldehyde is circulating.

Acknowledgment

The author expresses his appreciation to Stanolind Oil & Gas Company for permission to prepare and present this paper. The author wishes to thank and acknowledge indebtedness to the Stanolind personnel who have cooperated in this project.

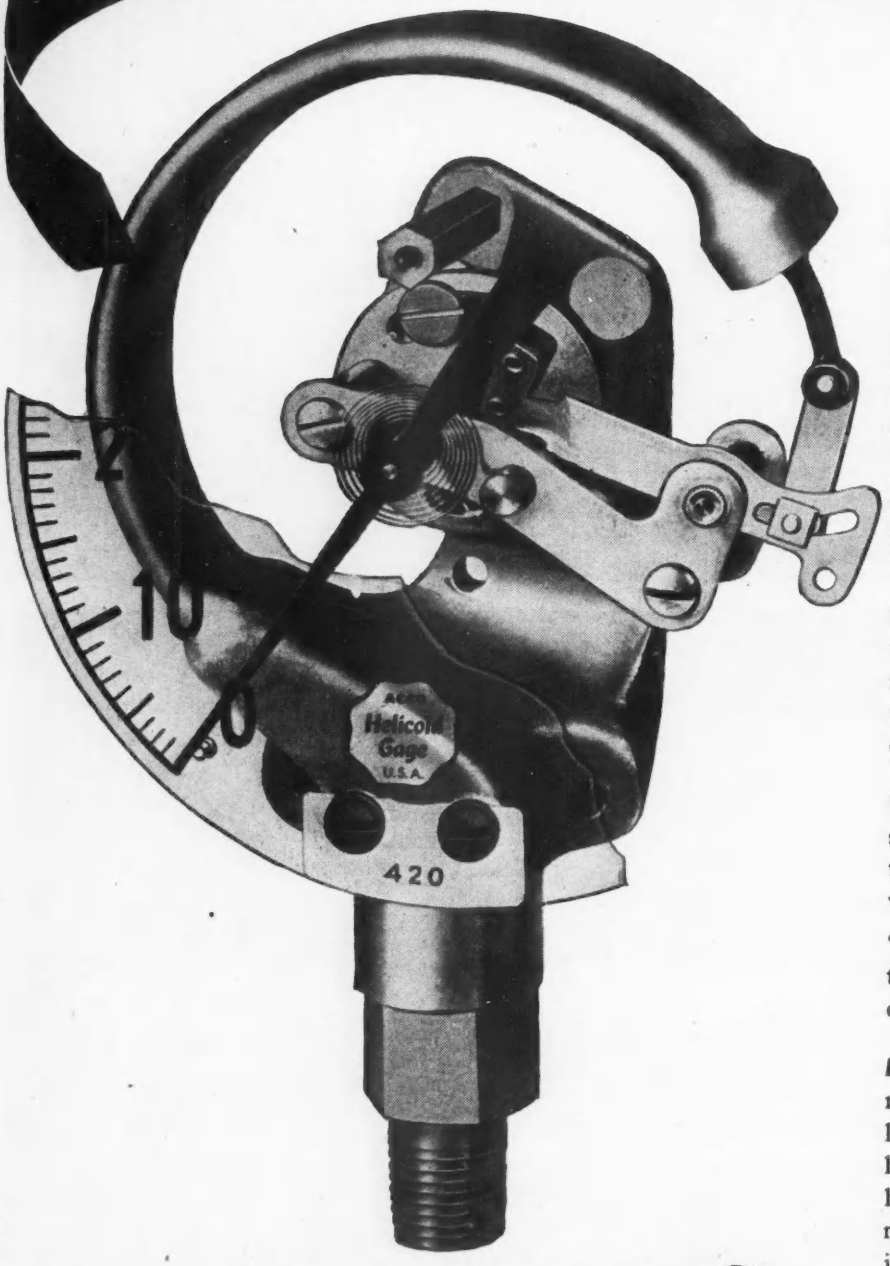
REFERENCES

[1] H. H. Anderson, *The Oil Weekly*, April 21, 1947. p. 58.

[2] P. L. Menaul and T. H. Dunn, AIME, Tech. Pub. No. 1970.

[3] J. A. Clay, Jr., *Petroleum Engineer*, November, 1946, p. 531.

THIS TUBE SAVED 10 GAGES



WORKING MECHANISM of the Helicoid Gage. Because of its low hysteresis drift and excellent resistance to corrosive media, "K" Monel is used for Bourdon tubing. *Photo courtesy of Helicoid Gage Div., American Chain & Cable Co., Inc., Bridgeport 2, Conn.*

In the Permian Basin area field at Odessa, Texas, Gulf Oil Corporation had been having trouble.

Corrosive West Texas crudes limited pressure gage life to a maximum of five or six weeks.

The picture was pretty gloomy until April 5, 1946. Then Gulf installed an ***AMERICAN CHAIN & CABLE COMPANY*** Helicoid Gage with Bourdon tubing of "K"* Monel.

Weeks passed – fifty-five trouble-free weeks. Finally, on April 25, 1947, Gulf removed the gage. There was no question of failure; Gulf simply wanted to check its condition.

What did they find? No pit marks. No signs of corrosion. What's more, the gage tested accurate, so back into service it went. And it's *still* on the job!

"K" Monel is used for Bourdon tubing in this Helicoid Gage because of its unique combination of properties.

Besides being strong, rustproof and highly resistant to corrosive media, "K" Monel has the *extra* strength and hardness of heat-treated alloy steels. It has the low hysteresis needed to assure gage accuracy. Its retention of good fatigue strength is evident in the long life of equipment subject to alternating stresses in the presence of corrosives.

To Helicoid Gages – as to so many other types of oil field and refinery equipment –"K" Monel helps bring hairline accuracy . . . trouble-free performance . . . and extended life.

Remember "K" Monel whenever you have to fight corrosion by high-sulfur crudes at temperatures under 500° F.

*Reg. U. S. Pat. Off.

"K" *MONEL

EMBLEM OF SERVICE
INCO
TRADE MARK

THE INTERNATIONAL NICKEL COMPANY, INC., 67 Wall Street, New York 5, N.Y.

HEATING HIGH-PRESSURE GAS FLOW LINES

To Eliminate Freezing at the Regulator

By J. E. KASTROP
Staff Writer

COST OF HANDLING high-pressure gas is substantially reduced if the pressure is brought down to a value permitting the use of medium-pressure equipment. Where the reduction in pressure is 50 percent or more, means must be provided for heating the gas to prevent freezing of the entrained hydrates at the point of pressure drop.

There are numerous leases producing gas at pressures exceeding 1000 pounds per square inch where this problem is serious. The method described utilizes standard equipment ordinarily found on a lease, and may be installed at a minimum cost.

THE terms "high-pressure and "deep wells" have changed their meaning considerably during the past decade. No longer is 500 pounds per square inch called high pressure, and an 8000-foot well is seldom referred to as a deep one. Today, high pressure is used to describe 5000 to 8000 pounds per square inch pressures, and a deep well is one below 10,000 feet. But, regardless of this change in meaning of these respective terms, the problems associated with them have not changed. A 50 percent drop in pressure across a constriction in a gas line still complicates the production problem, whether the upstream pressure is 1600 or 5000 pounds per square inch.

This drop in pressure means expansion of the gas with resultant drop in temperature. It is this lowering in temperature that brings about additional problems in high-pressure gas production. For, with a decrease in temperature to 32° F or below, there usually follows freezing of any hydrates that may be carried with the gas. The continual accumulation of frozen hydrates on the down-stream side of the flow line constriction eventually blocks the gas flow. Solution to the problem lies in increasing the temperature of the gas at this point above the freezing temperature of any hydrates that may be present. There are numerous methods of accomplishing this, many of which are complicated, expensive and require constant maintenance.

Simple Method

Simplicity in design, efficiency of operation and minimum maintenance are outstanding characteristics of a heating system designed to prevent the accumulation of hydrates at the regulator where the well pressure of 1600 psi is reduced to 850 psi before the gas is flowed into the high-pressure separator. The entire system has been in daily operation since 1938, providing satisfactory service with negligible upkeep.

Approximately 750,000 cubic feet of gas flows daily from the gas well through the heat exchanger element to furnish the energy to gas-lift nine oil producers in the same field. Sole function of the system was to eliminate freezing of the regulator, and it has performed that job well. Cost of installation was low due to

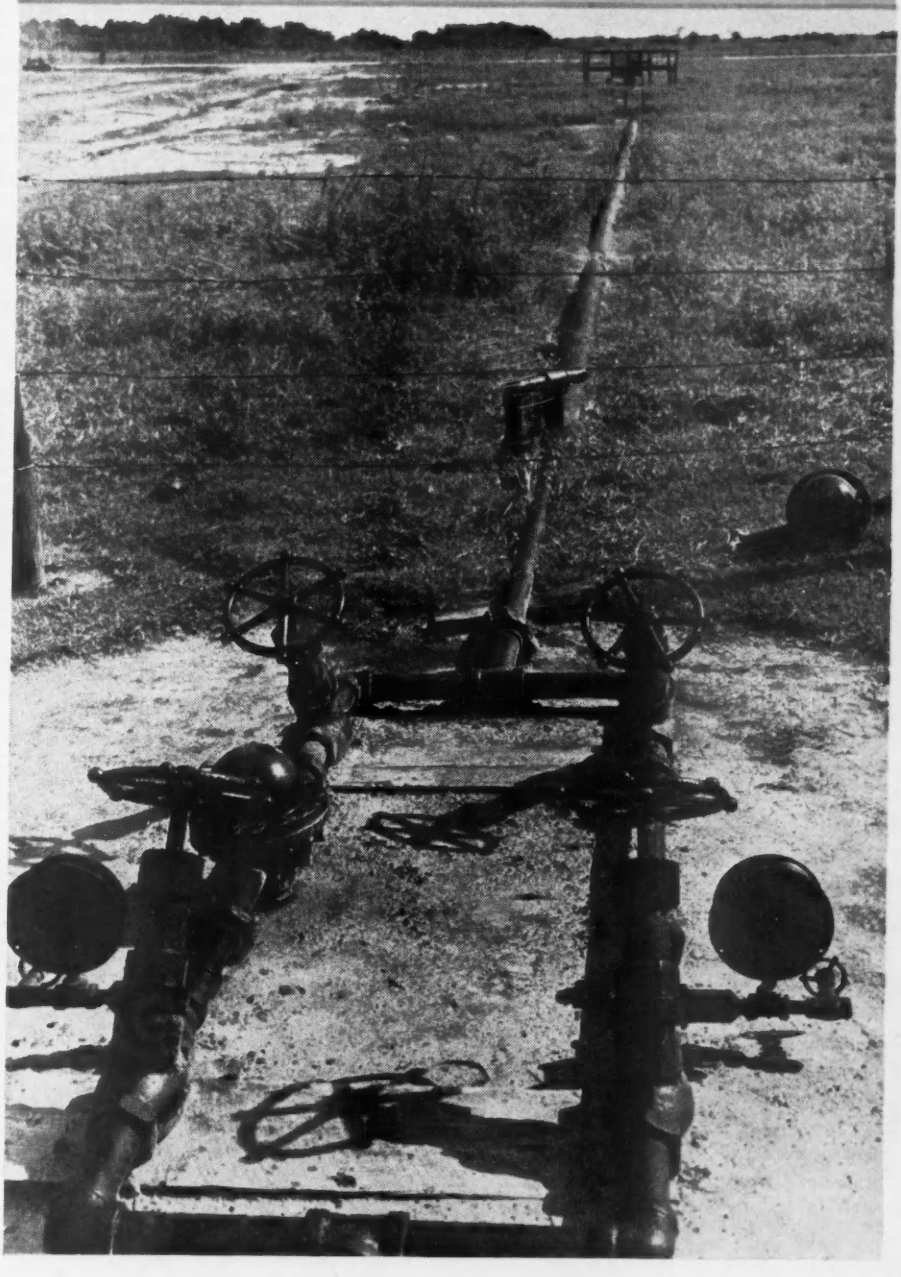


Figure 1. Looking down the high-pressure gas flow line with the gas well in the background. This view clearly show the regulator-bypass manifold hookup and the swing connection on the discharge end of the heat exchanger.

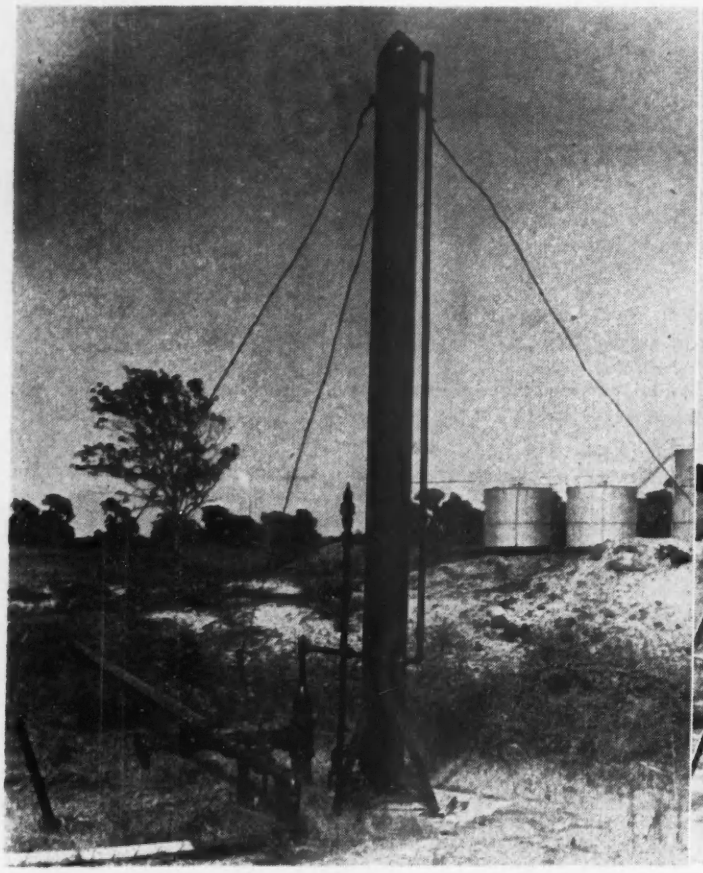


Figure 2. Connections to the gas-jetted water well with the gas-scrubber extending about 14 feet in the air. Water is jetted directly into an open earthen pit where it is stored until needed.

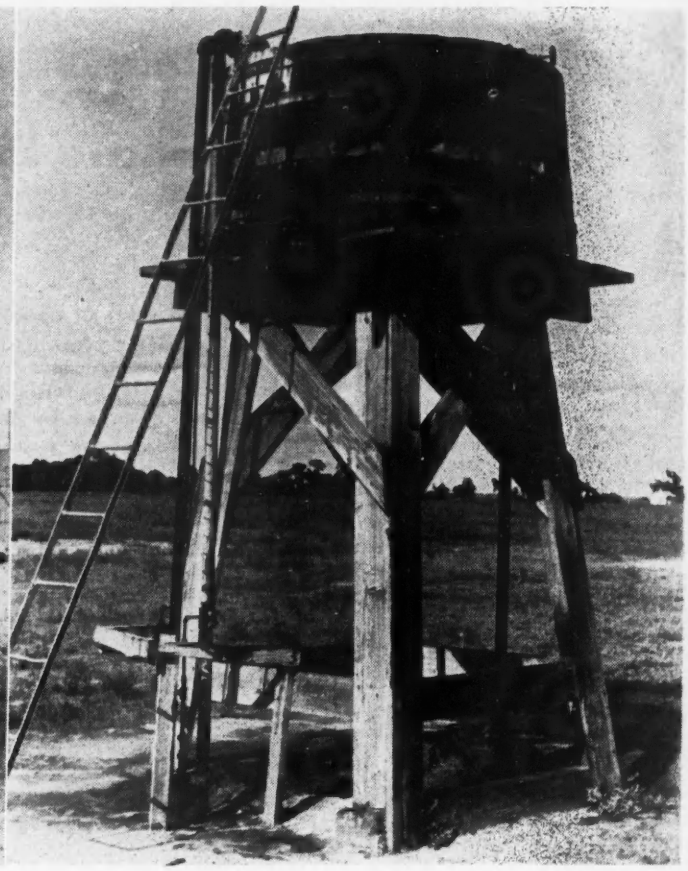


Figure 3. Water for the heating system is stored in this 100-barrel wooden tank. The lease pumper checks the water level in this tank two or three times weekly.

simplicity of the system, and the lease pumper need only to check the water supply two or three times each week, thus minimizing operating expense. The gas-fired heater is about 200 feet from the high-pressure separator and about 300 feet from the gas well. This distance eliminates fire hazard through gas that might escape from the well or the separator.

The flow-line heating system is illustrated in the schematic drawing. Gas at 1600 psi flows through extra-heavy two-inch pipe to the regulator-bypass manifold. The regulator drops the pressure to 850 psi, after which the gas passes into the high-pressure separator. The condensates are removed in the separator at no reduction in pressure. At 850 psi, the gas flows into the field system for distribution to each of the nine wells being produced by gas lift.

Before the gas reaches the first regulator as it comes from the well, it passes through a section of two-inch pipe which has been placed inside an 80-foot section of seven-inch casing, forming the heat exchanger element. The seven-inch section has been orange-peeled at one end and welded to the two-inch line, while the upstream end is fitted with an expansion joint between the two lines to compensate for any differences in expansion in the two and seven-inch lines. This forms a sealed annulus between the two pipes. A two-inch collar is welded to each end of the outer jacket to provide an intake and discharge for the flow of hot water through the annulus between the two-inch and seven-inch lines. This part of the system is pictured in Figure 1, looking down the flow line from the separator to the gas well. Hot water is slowly circulated through the heat exchanger element to bring the gas temperature up to 110° F. The gas has sufficient heat at this temperature to completely eliminate any freezing at the regulator. Only a slight sweating is noticed immediately downstream of the regulator where the temperature is approximately 60° F.

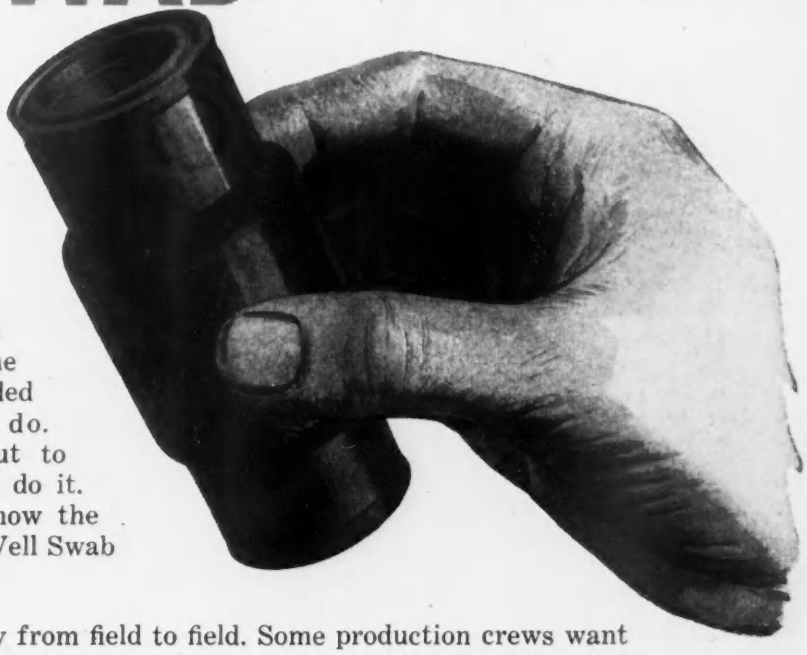
Water Supply and Storage

Water is furnished by a gas-jetted water well located on the lease. Gas used to lift the water comes from a nearby separator, under approximately 50 psi. Before it enters the macaroni string in the water well, the gas passes through a vertical scrubber about 14 feet high made from 8⅝-inch casing, as shown in Figure 2. Any liquid hydrocarbons remaining in the gas are removed in the scrubber to minimize contamination of the fresh water supply. The water is jetted directly into an open pit where it is stored until needed about the lease. A gas-powered 6 x 4 x 6-inch steam pump delivers water to other points about the lease when required. Instead of using steam, gas pressure from the lease (approximately 50 psi) furnishes the motivating power to operate the pump.

Water for the flow-line heating system is contained in an elevated 100-barrel wooden water tank, shown in Figure 3. The tank is open at the top with three lines leading up to the structure. One line furnishes water to replenish that lost due to evaporation or leakage in the system. This two-inch line originates at the 6 x 4 x 6-inch pump located at the open water pit mentioned above. A second two-inch line leads from the bottom of the water tank to a vertically-fired heater, equipped with three fire tubes, each three inches in diameter. The third two-inch pipe is the return line from the heat exchanger section on the high-pressure gas flow line.

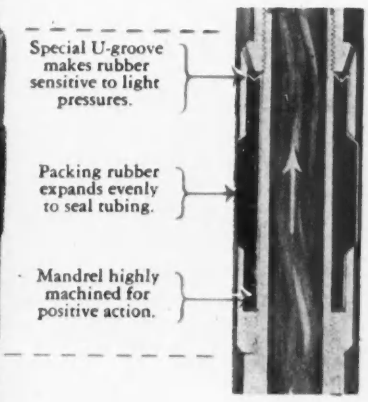
Figure 4 shows the vertically-fired water heater employed in the system. Cold water enters at the bottom and discharges near the top of the tube-fired section. A vertical riser open at the top is connected to the discharge line to provide a means of exhausting steam in case circulation in the system is disrupted for any extended period of time and the water boils. The vent also prevents steam-lock in the system, thereby stopping circulation of water through the

HERE'S THE SWAB YOU ASKED FOR!

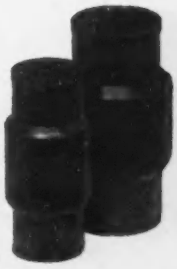


Old hands at swabbing all over the country told us the kind of swab they needed and what it should do. Patterson-Ballagh set out to make a swab that would do it. It was a big order but now the Patterson-Ballagh Deep Well Swab fills the bill.

Methods of swabbing vary from field to field. Some production crews want a gentle swab with sensitive packing rubbers that expand under light fluid loads at slow line speeds; others need to lift deep, heavy loads rapidly. The normal rubber o.d. must be small enough to allow *fast dropping* through restricted and paraffin coated tubing. For the same reason, a large internal fluid passage is necessary and also reduces the possibility of the swab blowing out of the hole. Besides giving the swab a sensitive "feel," swab rubbers have to be tough, wear and oil resistant; requiring no adjustment and pulling a full load every trip. This is what you asked for in a swab; this is what the Patterson-Ballagh Swab gives you.


Special U-groove makes rubber sensitive to light pressures.
Packing rubber expands evenly to seal tubing.
Mandrel highly machined for positive action.

You get these results because of the teamwork of Patterson-Ballagh chemists, engineers and field men. Our chemists tried many PBX Special Rubber Formulas before they found one with the right swabbing properties. Our engineers had to work out a new mold design for each rubber type to get full expansion under all pressure conditions. In each case, our field men checked actual tests all over the country both when bringing in wells and when reconditioning them. The result is a Deep Well Swab which we have full confidence in recommending to you. For positive swabbing, ask your Patterson-Ballagh man for specifications and order from your Supply Store.



Specify

PATTERSON-BALLAGH

DIVISION OF BYRON JACKSON CO.

"Best Bet Yet!"

PATTERSON BALLAGH · SEAL OF QUALITY · OIL FIELD SPECIALTIES

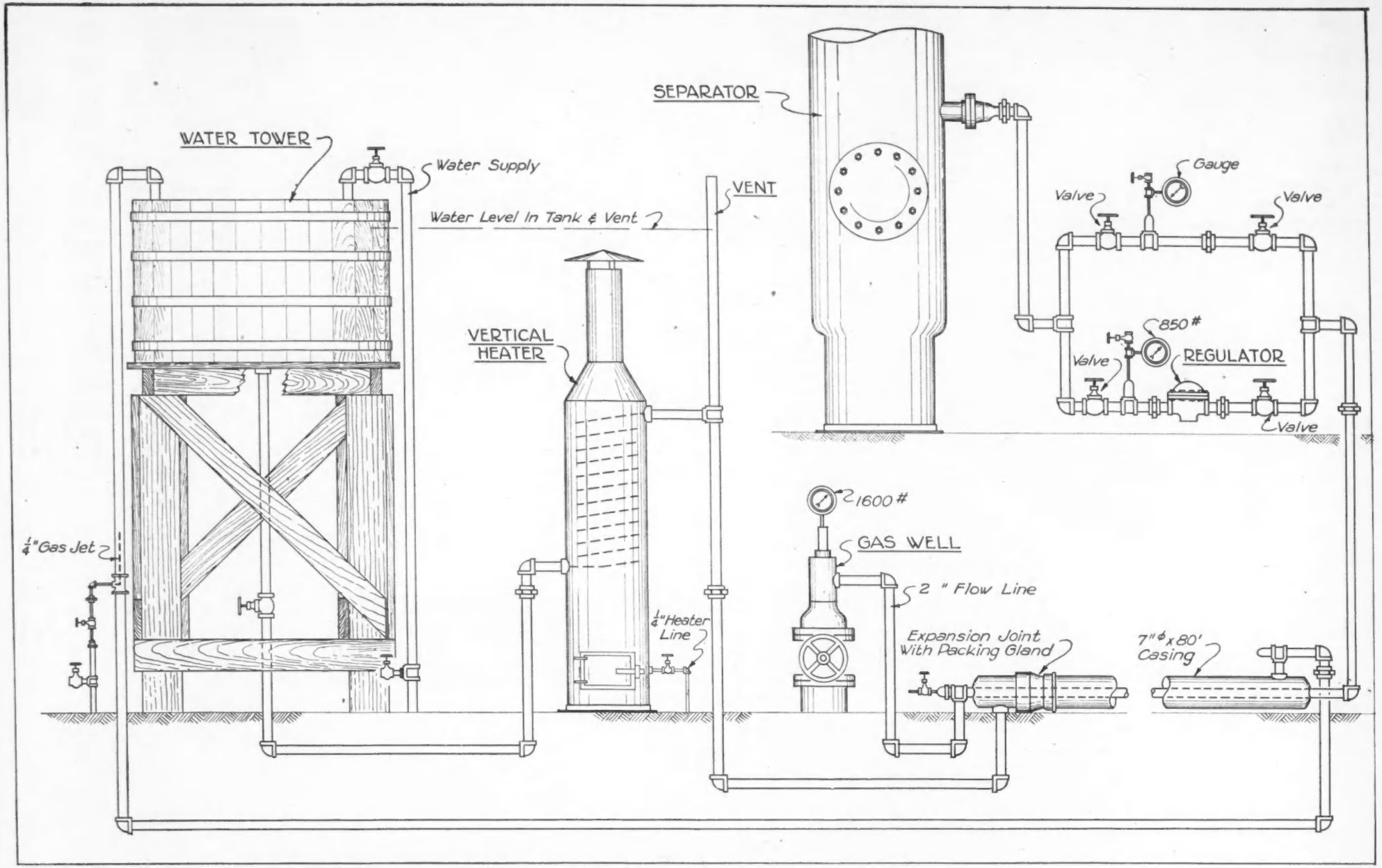
DEEP WELL SWABS

Main Office:
1900 E. 65th St.
Los Angeles 1

★ 6427 Navigation Blvd.
Houston 11

★ 808 Graybar Bldg.
New York 17

★ 931 Russ Bldg.
San Francisco 4



Diagrammatic sketch of the complete high-pressure gas flow line heating system showing the connection and relationship between the component parts. Path of water circulated through the heater system may easily be traced by beginning at the bottom of the water tank, entering the heater, then into the heat exchanger and back into the water tower. The gas jet in the return line provides the energy to maintain circulation, slowly but surely.

system. Top of the riser is above the water level in the water tank so that overflow through the riser is not possible. The heater is fired with lease gas furnished through a ½-inch gas line from the low pressure trap on an adjacent tank battery.

The flame under the heater is regulated so that sufficient heat is transmitted to the water to heat the gas to 110° F. This flame setting will vary according to the season, requiring less heat in the summer than in winter. Hot water discharging from the heater is below boiling, and once the flame has been regulated properly, no change is made until an abrupt change in the weather occurs.

From the heater, the hot water flows through a two-inch line directly into one end of the seven-inch pipe shell. The hot water enters the annulus between the outer shell and the flow line wherein the gas is heated. After the water passes through the heat exchanger, it is returned to the elevated water storage tank to be recirculated through the system. The gas, flowing through the two-inch line inside the heat exchanger, passes into the regulator-bypass manifold at approximately 110° F. and 1600 psi. The regulator reduces the pressure to 850 psi, which reduction brings about a cooling of the gas down to about 60° F. From this point, the gas enters the high-pressure separator where any liquid fractions are removed, and the clean gas passed into the distribution system. The four needle valves in the manifold make it possible to bypass the regulator and continue gas production while the regulator is removed for repairs or adjustment.

Jet Circulation

Water placed in the open tank completely fills the system and seeks its own level in the return line from the heat exchanger. This return line extends slightly above the top edge of the tank and is diverted 180 degrees back into the tank. When equilibrium in the system is attained, the water level in the return line will be at the same elevation as the water level in the tank.

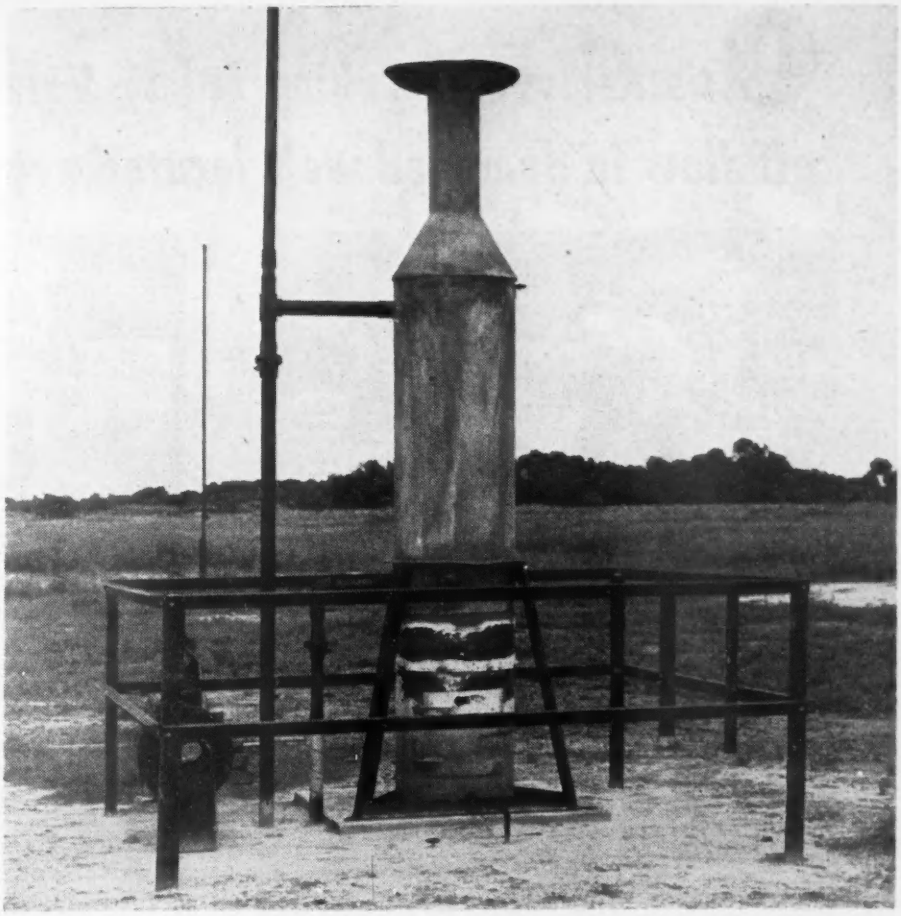


Figure 4. The vertical fire-tube heater used in the system. The vent connection to the heater discharge extends higher than the water level in the water tank. In this manner, any steam formed may be vented, and the water will not overflow through the vent because of its elevation.

One of the unique features of the entire system is the method of circulating the water through the heat exchanger. All that is required to circulate the water through the system is to lift the water in the return line up and over the top edge of the elevated tank. Since it is not necessary to circulate the water in large volumes, adequate circulation is provided by a ¼-inch gas jet, not a pump. The ¼-inch gas line is tapped on the water return line about three feet above ground level. By cracking a needle valve in this line, the exhausting gas lifts some of the water back into the elevated tank. This gas also is furnished by the lease gas system which obtains its supply from the low-pressure separators operating at 50 psi.

The rate of circulation in the heating system is governed by the amount of gas permitted to be jetted up into the water return line. The gases exhaust into the atmosphere after lifting the water "over the hump" into the water tank. This amount of water is replaced by the water stored in the tank, thus circulation of water through the heater, into the heat exchanger section and back into the tank is maintained slowly, but in sufficient quantity to heat the high-pressure gas, and thus eliminating freezing at the regulator.

Equipment employed in this flow-line heater is far from being elaborate. In fact, some of the material was salvaged from other leases. There are no moving parts to wear out and replace, and all that is required of the pumper is to see that sufficient water be maintained in the elevated tank to insure circulation, that the flame in the heater be adjusted to suit climatic conditions and that the jet in the return water line furnish enough gas to lift the water back into the tank.

This is but another instance where the ingenuity of the oil man has brought about a simple but efficient solution to a serious production problem.

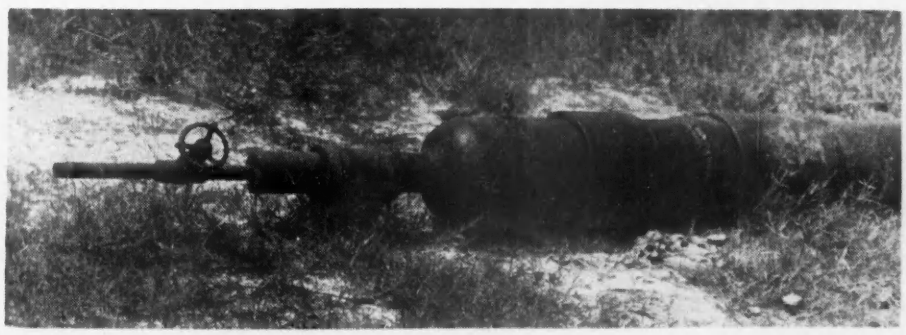


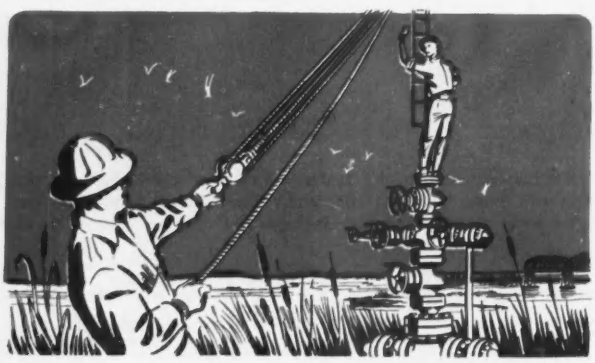
Figure 5. The expansion joint placed on the upstream end of the heat exchanger to compensate for any difference in lateral movement between the outer seven-inch casing and the two-inch flow line welded inside the casing.

Otis Removable Tubing Safety Valve automatically shuts off flow in damaged well located near big Louisiana bridge

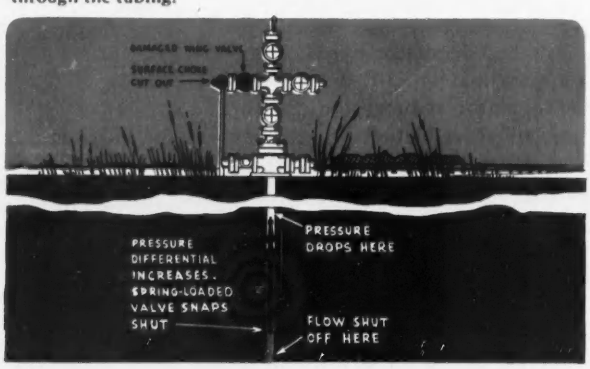
as told to W. T. MORRIS

1 "On July 3, 1942, we received a request from a major company to install an Otis Removable Tubing Safety Valve in one of their Westwego Field wells. Inasmuch as this 7000 foot well had been completed in the low marshy land near the Mississippi and less than a mile from the Huey Long Bridge, New Orleans, the company was fully aware of its vulnerability to high water and the damage which might occur to local transportation and property in case surface connections ever failed or became damaged and allowed the well to flow wild.

2 "Since the tubing had already been run, we chose to install a Type FB Safety Valve which can be set at any desired depth. We then observed flow tests and selected an orifice for the Safety Valve bean which would allow a desired maximum rate of flow at 1700 p.s.i. and set the compression of the coiled spring, which holds the Valve in an open position, to equal a differential pressure of 500 p.s.i. In other words, in case the upward thrust of the pressure differential across the flow bean exceeded that of the spring, the valve would automatically close and shut off all flow through the tubing.



3 "On March 7, 1943, nine months after this installation had been completed, the company called again and asked us to send a service crew to this same well as soon as possible. When we arrived we learned that flow had stopped and that they wanted us to pull the Safety Valve, clean the well, re-set the Safety Valve, and put the well back on production. Inasmuch as it had been operating normally at 1700 p.s.i. on the previous day, it was their belief that the well had sanded up. When the crew arrived they rigged up our regular wire line equipment used to run and pull Otis Removable Sub-Surface Controls and checked for sand. However, they found none.


DAMAGED WING VALVE
SURFACE CHOKE CUT OUT
PRESSURE DIFFERENTIAL INCREASES. SPRING-LOADED VALVE SNAPS SHUT
PRESSURE DROPS HERE
FLOW SHUT OFF HERE

4 "Further inspection revealed that Xmas tree connections were practically cut off and damaged beyond repair. The surface choke was completely cut out and the wing valve was so badly damaged that it would not close. Thus, it was immediately evident that our automatic "Storm Choke" had performed its job quickly and efficiently. When surface connections began to fail the increase in rate of flow caused an increase in differential across the Safety Valve in excess of that for which the Valve was set, and the automatic mechanism snapped shut and prevented disastrous uncontrolled flow through the tubing.

5 "Needless to say, this company is thoroughly 'sold' on the installation of Otis Removable Tubing Safety Valves in wells completed near rivers, highways, industrial areas or townsites, and in other critical zones. Although they had maintained constant check on this particular well, connections failed without warning, and only by their foresight of having installed automatic sub-surface protection was incalculable damage and financial loss avoided."

This is the fourth in a series of advertisements covering actual installations of Sub-Surface Controls and subsequent service as described by Otis Pressure Control, Inc., field personnel. Except for necessary deletion of company and trade names these reports are unedited. For further details on equipment and service, write Otis Pressure Control, Inc., P. O. Box 7206, Dallas.

(T-5)

PRESSURE CONTROL — OTIS — SERVICE - EQUIPMENT

T. M. REG.

OTIS PRESSURE CONTROL, INC.

FIELD OFFICES: **TEXAS:** HOUSTON, CORPUS CHRISTI, and LONGVIEW. **OKLAHOMA:** OKLAHOMA CITY. **NEW MEXICO:** HOBBS. **LOUISIANA:** NEW IBERIA

OTIS ENGINEERING CORPORATION — MANUFACTURE AND DEVELOPMENT

DISTRIBUTORS: **OTIS PRESSURE CONTROL, INC.,** DALLAS, TEX.; **OTIS EASTERN SERVICE, INC.,** BOLIVAR, N. Y.; **WESTERN PRESSURE CONTROL,** LOS ANGELES, CALIF.

EXPORT SALES AND SERVICES: **OTIS PRESSURE CONTROL EXPORT, INC.,** POST OFFICE BOX 7206, DALLAS, TEXAS, U. S. A.; CARACAS, SOUTH AMERICA

Bottom-Hole Separator

CONSERVES RESERVOIR ENERGY

By KORK KELLEY

REDUCTIONS in gas-oil ratios and increases in production have resulted from the proper application of the bottom-hole separator to petroleum reservoirs in the pumping stage. Though not applicable to all types of wells, the separator has brought satisfactory results in many cases by eliminating excessive waste of gas, the agent which aids the flow of reservoir fluids into the well bore. Development of the device is based on the assumption that a maximum volume of oil may be taken from a reservoir in the pumping stage if reservoir conditions can be maintained as nearly as possible in a state of equilibrium. Such a method of production requires that a minimum volume of free gas be produced along with the fluids.

Until recent years, it was common practice among producers of oil to flare all the gas which accompanied the oil in its movement from the reservoir to the surface. In so doing, many ills of the oil well, both to the reservoir and to the physical equipment, were brought about; to say nothing of the resulting waste of reservoir energy or the stored horsepower which moves the oil from its place in the sand pores to the bore hole.

A great deal of the damage to the reservoir and the wasting of reservoir energy occurs during the early life of the well, or during the time when the well is flowing by virtue of gas pressure in the formations. To flow a well under its own pressure is seemingly a cheap way of lifting oil, but in the long run it is costly when the value of the gas wasted into the air is considered. Only that part of the gas which is necessary to move the oil into the well bore should be used, and other means employed to convey it to the surface. In most cases, the ultimate recovery of fluids from pumping will be greater from such a method of production than the volume recovered from open flow.

Paraffin Problem

One of the most serious conditions resulting from the open flow or the let-come-what-will method of production is accumulation of paraffin and mineral deposition on the face of the producing zone. Such accumulation is brought about by the expansion of the gas from the reservoir pressure to the open hole. This drop in pressure results in a chilling or refrigerating effect that congeals the oil at the point where the reduction in pressure occurs. This reduction is greatest at the well bore or across the face of the producing formation.

Water-flooding in some old pools has proved that even with present-day methods of production, as much as 80 percent of the oil is left in the reservoir. Had the gas pressure been conserved in the early life of the reservoir, undoubtedly more oil would have been moved into the bore and thus into the stock tanks.

If paraffin deposition is occurring at the face of the producing zone, this means then that the way for other oil to move into the drill hole is being blocked. Had some restricted method been employed in the beginning other than the open flow, these conditions would have been retarded or at least extended over a much longer period of time.

In a pool untouched by the drill, it is possible for the reservoir to contain three substances: oil, water and gas. It also is possible that all of these substances can be segregated due to their differences in density or unit weight. Suppose, then, the drill enters this reservoir and opens up the producing zone, which has an assumed thickness of 30 feet. If the well is shut in at the surface, the reservoir would take the same state of equilibrium that was established therein before it was touched by the drill. This being true, the 30-foot column would contain gas, oil and water, or probably gas and oil under its original formation pressure.

If by mechanical means some of the liquid is removed from the bore, there would be room for other liquid to move into place without passing one cubic foot of free gas at the surface. The gas cap would expand as the liquid was removed and a slight drop in pressure within the reservoir would result. The gravitational segregation of the liquid and gas would tend to maintain movement of the liquid toward the bore or point where the liquid was withdrawn. Thus, there would always be a state of equilibrium between the free gas and liquid due to their differences in density. This rate of fluid movement into the bore hole would not be as great as that with differential flow methods of today, but the ultimate return in total volume produced would be greater.

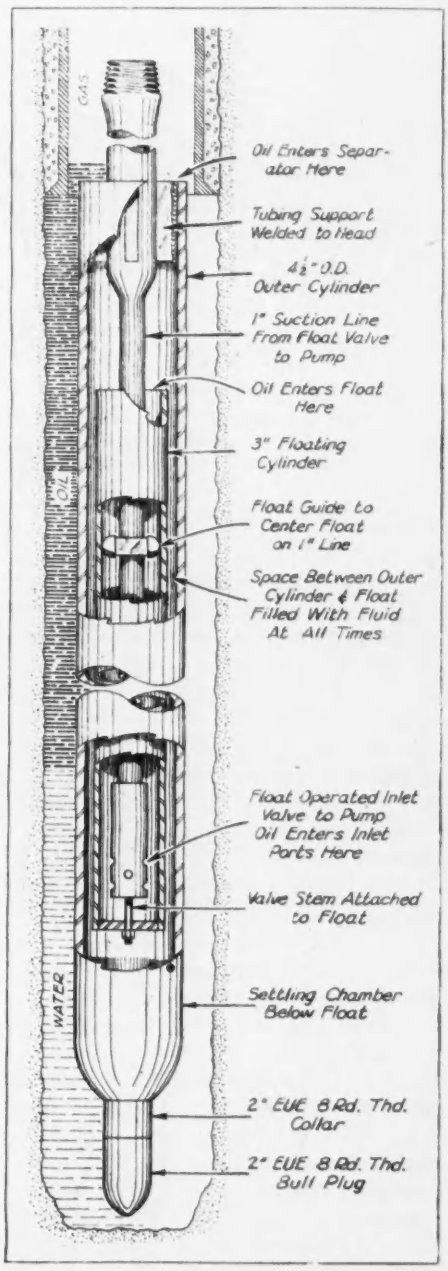

GAS
OIL
WATER
Oil Enters Separator Here
Tubing Support Welded to Head
4½" O.D. Outer Cylinder
1" Suction Line From Float Valve to Pump
Oil Enters Float Here
3" Floating Cylinder
Float Guide to Center Float on 1" Line
Space Between Outer Cylinder & Float Filled With Fluid At All Times
Float Operated Inlet Valve to Pump Oil Enters Inlet Ports Here
Valve Stem Attached to Float
Settling Chamber Below Float
2" EUE 8 Rd. Thd. Collar
2" EUE 8 Rd. Thd. Bull Plug

Figure 1. Schematic diagram of the patented bottom-hole separator showing its location with respect to the oil level in the well.

The problem of keeping the gas in petroleum reservoirs under sufficient pressure to flow naturally is not the scope of this paper. The bottom-hole

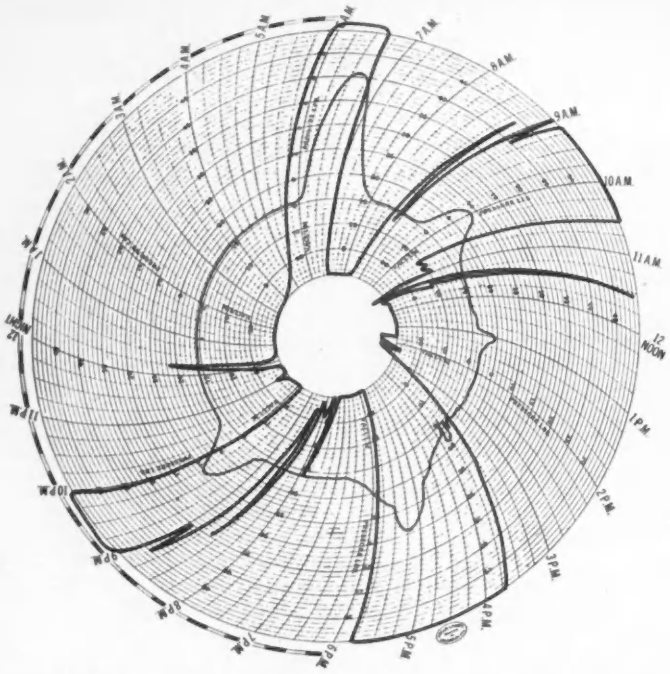


Figure 2a. On February 28, 1943, this chart was made in connection with a 24-hour test on a well in the KMA field, Texas, and shows the separator pressure (heavy lines) and the differential pressure (thin lines).

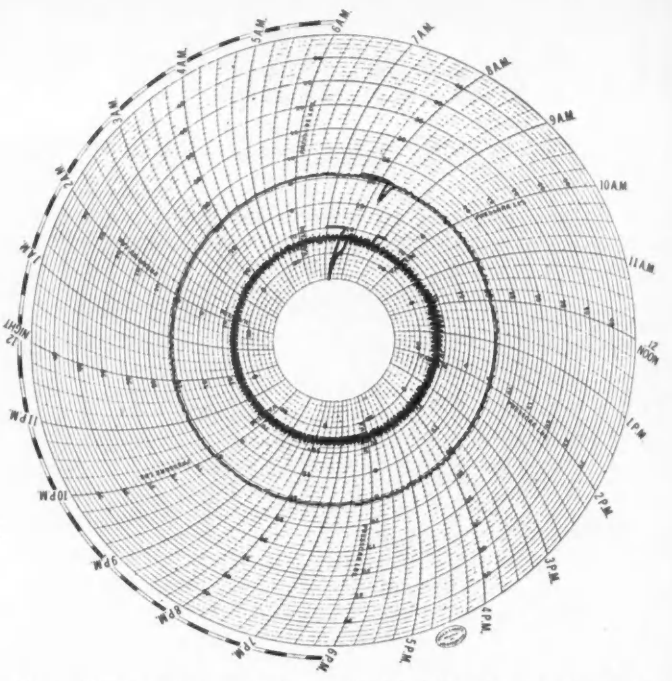


Figure 2b. This chart was taken on April 5, 1943, after the bottom-hole separator had been installed. Note how the well stabilized itself as compared with erratic production indicated on Figure 2a. Gas-oil ratio was reduced from 3784/1 to 1173/1.

separator discussed in the following paragraphs is not intended for wells in the flowing class, but represents a method of conserving as much as possible all the free gas left in reservoirs which must be pumped. The separator has been developed to trap the free gas at the bottom of the well and to prevent it from entering the working barrel of the pump, so that only that gas which is in solution is produced through the tubing.

As the name implies, the bottom-hole separator is located at the bottom of the hole on the tubing string below the pump. It consists primarily of two concentric cylindrical chambers sealed at the bottom and opened at the top, and a sliding-type valve actuated by the vertical movement of the inner cylinder. The outer chamber is suspended from the top by the tubing section, which is attached directly to the pump. The inner chamber is secured to the sliding mechanism of the valve (see Figure 1), and held in position within the outer chamber by means of float guides spaced radially about the one-inch suction line. The suction line is reduced from tubing size down to one inch at the top of the outer chamber, and extends to the valve section inside the bottom of the float chamber. The stationary body of the sliding valve is attached to this suction line.

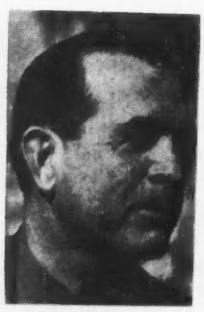
Operation of the separator is based on Archimedes' principle of buoyancy. With liquid in the outer chamber, the inner chamber floats, due to its displacement of the fluid. Vertical movement of the float chamber is limited by the sliding valve, and the chamber will rise only to the upper limit of the valve. In this up position the valve is closed, and any connection between the tubing and the well is sealed.

The valve remains closed until the float descends to its lower position. As the liquid continues to overflow into the outer chamber, the latter is filled to a point where the liquid spills over into the float chamber. When both chambers have been filled, the float chamber will fall due to its own weight. As it falls, the sliding valve slowly opens to permit the pump to suck the liquid from the float chamber and convey it to the surface. As the float chamber is emptied of its contents, it again floats to close the valve, thus preventing any fluid movement into the tubing. The process is repeated over and over to permit the removal of liquids, but leaving the free gas in the well to further aid in the movement of fluids into the well bore. Size of the port openings in the sliding valve, or the area through which the oil is drawn into the suction line, is determined by the amount of oil the reservoir is capable of producing under this method. If the displaced liquids are quickly replaced by the reservoirs, the area of the valve ports will be larger than in the case where the reservoir gives up its liquids relatively slow.

Location of the separator in the hole depends primarily on the liquid level in the well. It should be placed so that the upper edge of the outer chamber is below the surface of the liquids when equilibrium in the reservoir exists. This insures a continual overflow of liquids into the separator. Purpose of the outer chamber is to direct the flow of liquids into the separator and to the pump. Gas pressure in the well has no effect on the operation of the float, since it is open, the pressure being equal inside and out, causing it to become a fluid-balanced valve, which acts as a bottom-hole choke.

First installation of the bottom-hole separator was in the Salem field, Illinois, where a well was making approximately 60 barrels per day with no back-pressure on the casing. Due to excessive flow

About the Author



KORK KELLEY, ignition engineer on the first gasoline plant built west of the Mississippi River in the Alluwe field, Oklahoma, has had long experience in the design and construction of casinghead gasoline plants. In 1928, he drilled a successful wildcat near Electra, Texas, and formed the Easter Oil Corporation which he headed until 1935. Since that time, he has devoted himself to the development of production methods and equipment for oil wells, and at present is head of the Kork Kelley Production Engineering Company of Wichita Falls, Texas.

JENSEN

Begins 28th YEAR

of MAKING BETTER PUMPING UNITS

Nowata, Oklahoma, was our first home. That was way back in 1919.

Soon, the demand for our pumping equipment exceeded facilities there, so we moved to Coffeyville, Kansas. Here, over a period of years, we have built the modern factory in which Jensen Pumping Units are now mass produced.

As the oil industry has drilled deeper, the design of our units has been changed to carry longer strings of rods and to lift oil more efficiently from greater depths.

Today Jensen Units—our customers tell us—do a remarkable job of meeting current production problems.

But we know that new and more difficult problems are ahead. It is to this end that we are now working. We have the experience, the facilities and a burning desire to have the right equipment ready whenever you need it.

JENSEN BROTHERS MFG. CO.

COFFEYVILLE, KANSAS

EXPORT OFFICE: 50 CHURCH ST., NEW YORK CITY

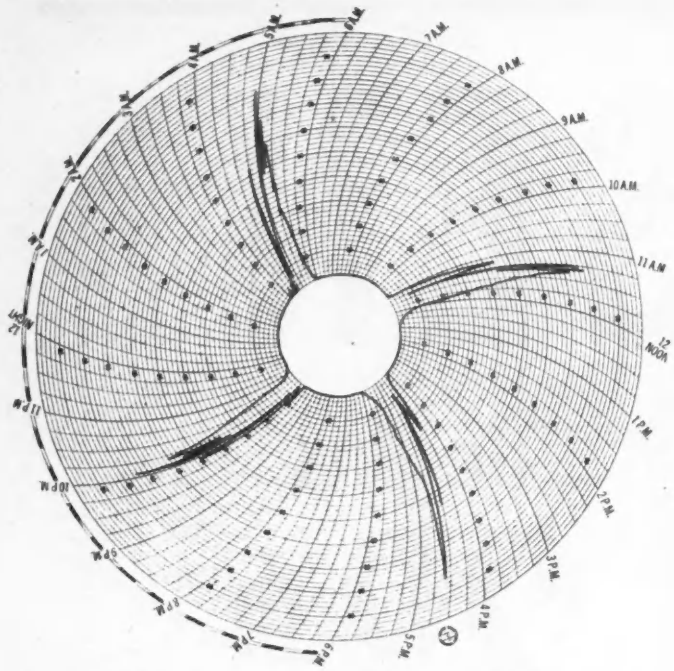


Figure 3a. Recorded separator pressure of July 7, 1943, shows four surges daily from this well in the KMA field, Texas. Daily production: 8.4 barrels of oil, 4.2 barrels of water.

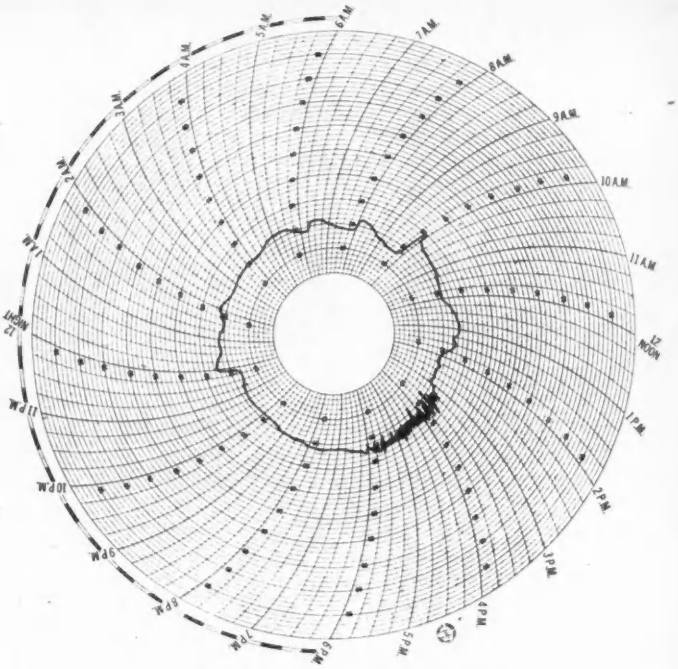


Figure 3b. After the bottom-hole separator was installed, daily production rose to 28.7 barrels of oil, no water, with recorded separator pressures shown on the chart.

of gas from the McClosky lime, the well was killed. The separator was installed in 1942 and the well placed on the pump with 80 pounds back pressure. Production increased to 260 barrels per day. A year later, production decreased to 210 barrels per day, but the well had not required any servicing. Seven months later production dropped to 208 barrels per day and still had not required any form of servicing.

A relatively recent installation was made in the West Columbia field, Brazoria County, Texas. Total depth was approximately 5500 feet, with 100 feet of blank liner hung above 60 feet of screen liner. Shutin pressure ranged from 350 to 400 pounds per square inch. During January, 1947, production averaged less than 25 barrels of oil and 1½ million cubic feet of gas per day. The well was serviced during February and the bottom-hole separator installed 170 feet off bottom (due to liner) during the latter part of that month. Recorded production during March averaged 66.28 barrels per day with the volume of gas reduced to less than half its former amount.

An example of reduction in gas-oil ratios obtained with the bottom-hole separator may be found in the KMA field in North Texas. Before the device was installed on one particular well, conditions reported on February 28, 1943, were as follows: casing pressure, 200 pounds per square inch; oil, 20.6

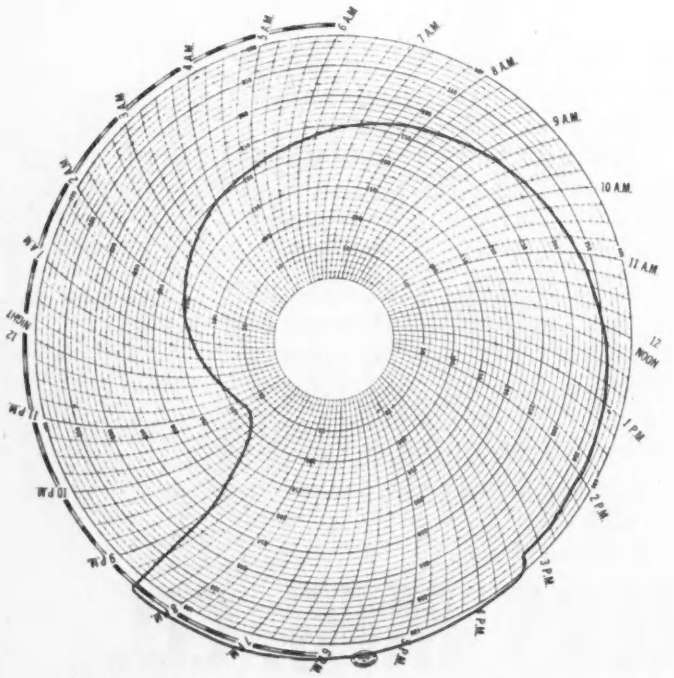


Figure 4a. 24-hour chart record indicating casing pressure on offset well before installation of bottom-hole separator. Note: Well surged each morning at 8:30 to produce about four barrels of oil.

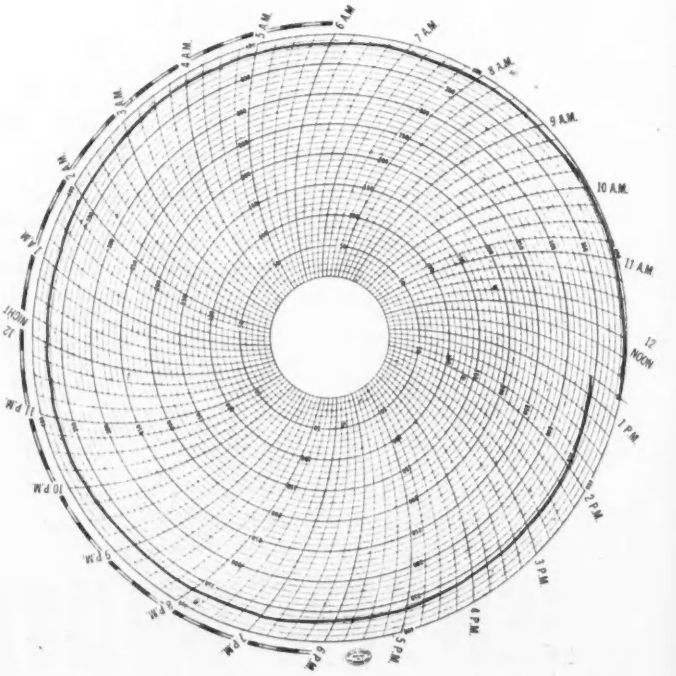


Figure 4b. After the bottom-hole separator was installed, the well stabilized as indicated by the steady casing head pressure shown on this 24-hour chart. The well produced 22.64 barrels daily.

You can't beat this fact . . .

DRISCOSE is a Driller's Mud!

- **DRISCOSE IS EASY TO USE...EASY TO CONTROL**
- **IT HELPS MAINTAIN CORRECT HOLE SIZE**
- **TOTAL MUD COSTS ARE HELD TO A MINIMUM**

Write for Field Data

DRILLING SPECIALTIES COMPANY

BARTLESVILLE, OKLAHOMA

DRISCOSE

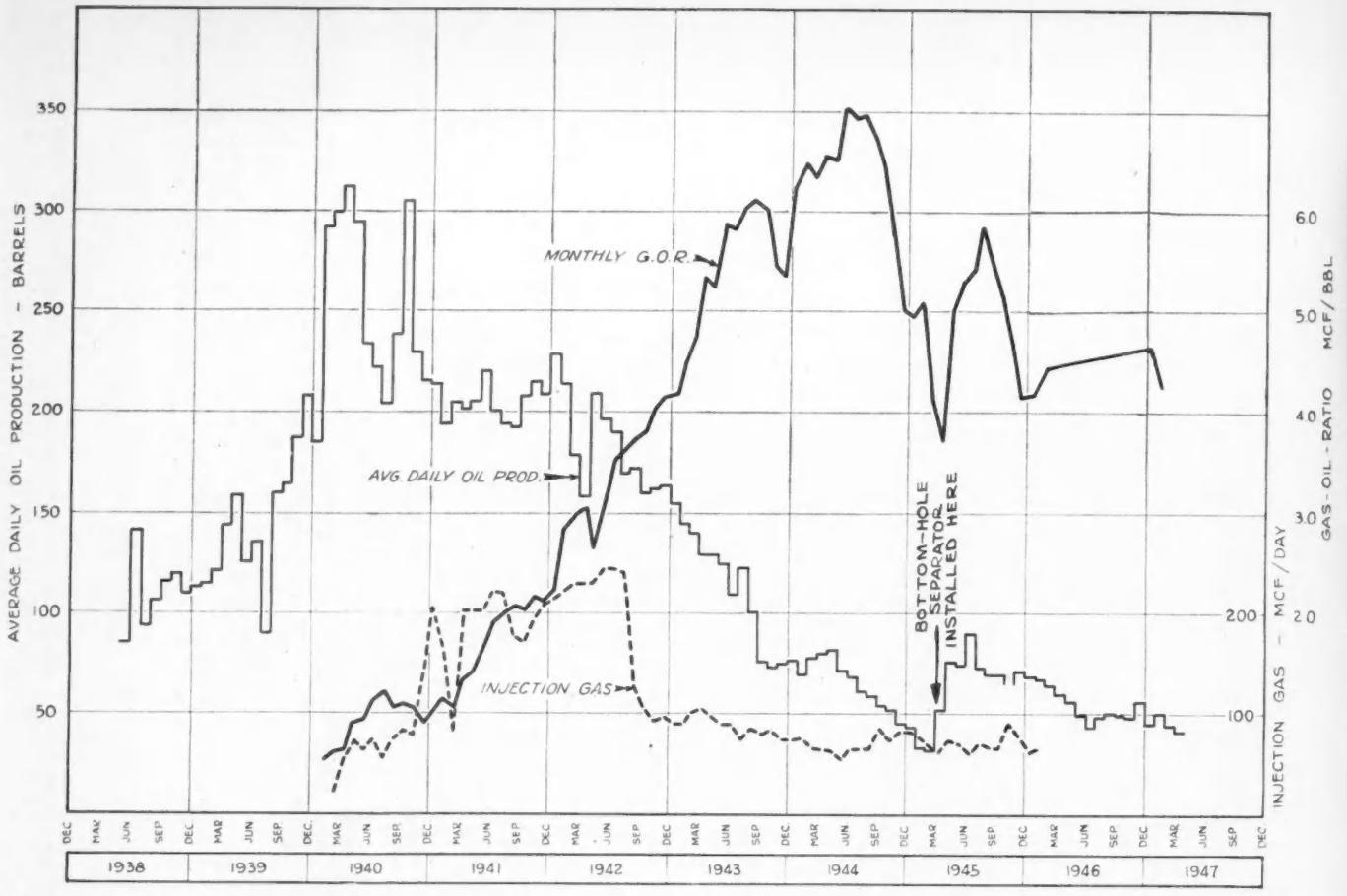


Figure 5. Performance chart from a lease in the KMA field. Seven of the nine producing wells were equipped with the bottom-hole separator, the first installation being in March, 1945; followed by others in April, May and June, 1945. The lease contained one gas injection well.

barrels per day; gas, 77,800 cubic feet per day; gor, 3784/1. The meter chart shown in Figure 2a recorded the separator pressure (also the tubing pressure) during this 24-hour test. The bottom-hole separator was installed, and a 24-hour production test made on April 5, 1943, resulted in the following report: oil, 30.26 barrels per day; gas, 35,500 cubic feet per day; gor, 1173/1. Separator pressures are indicated by the meter chart shown in Figure 2b. Previous to this installation, considerable trouble was caused from stuffing boxes burning out. This trouble was eliminated after the separator was installed. The number of strokes per minute on the pump and a casing pressure of 200 pounds remained constant before and after the installation.

Another example from the KMA field is illustrated in Figures 3a and 3b. During July, 1943, best production on a 24-hour test from this well was 8.4 barrels of oil, 4.2 barrels of water, and 42,576 cubic feet of gas per day with a gor of 5086/1. Casing pressure in this well also was 200 pounds per square inch. The bottom-hole separator was installed and after the well settled down, a 24-hour production test showed that the volume of oil had increased to 28.7 barrels, no water, and 49,859 cubic feet of gas daily. The gas-oil ratio was reduced to 1737/1. Tubing pressures before and after installation are shown in the recording charts of Figure 3a and 3b, respectively.

Visual evidence of the stabilizing effect of the bottom-hole separator on surging wells may be illustrated by the meter charts shown in Figures 4a and 4b. The producing well was an offset (about 900 feet) from a key injection well in the North KMA field, Texas. It was found that the injected gas was channeling to the offset well. In an attempt to minimize this channeling, the casinghead pressure on the offset well was increased to 450 pounds per square inch. But, as evidenced in Figure 4a, the well surged daily, dropping the casing pressure to 80 pounds. The well produced about four barrels daily under these conditions.

On May 13, 1944, after the bottom-hole separator had been installed, the chart shown in Figure 4b was taken. Casing pressure remains very close to about 380 pounds per square inch, with production increasing up to 22.64 barrels daily. In neither case was the gas-oil ratio estimated. Ordinarily, greater movement of oil into the bore would be expected when the pressure was lowered to 80 pounds, as reflected on the chart. However, this was not the case, as production figures indicated. When the casing pressure built itself up to reservoir pressure, the well stabilized itself, and better movement of oil into the bore resulted as later production tests showed. The previous surging caused loose sand to move into the well at the bottom, giving rise to numerous sand troubles in the pump. When the well was stabilized, these troubles were eliminated.

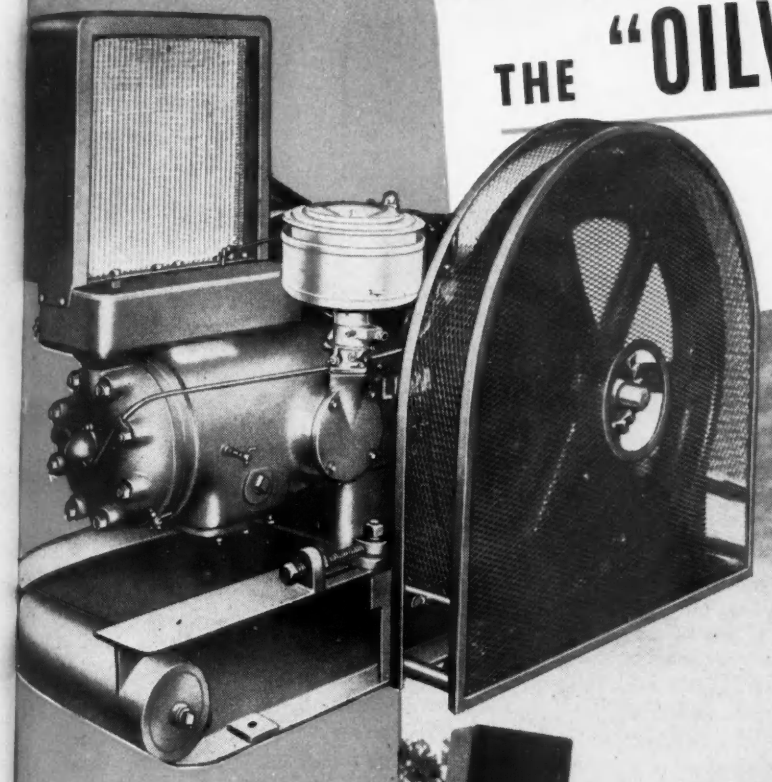
With demand for petroleum at unprecedented peaks, and all indications pointing toward heavy demands in the future, the industry can ill afford to waste valuable gas which can be used to move oil from its storage in the formation into the bore hole. Reservoir engineers realize how unwilling some formations can be in giving up valuable fluids, and that the forces stored in these formations are the most efficient agents in the production of these fluids. The bottom-hole separator was developed to conserve a maximum of reservoir energy and to provide a maximum recovery of oil from reservoirs in the pumping stage.

2 More *GREAT* Oil-Field Engines!

THE "OILWELL"-LORAIN

Type "L" With 10.7 to 21.4 H.P. at 300 to 600 R.P.M.

Type "O" With 21 to 32 H.P. at 300 to 450 R.P.M.



2-Cycle Liner Type

"Oilwell" TC-23 Pumping Unit, powered by an "Oilwell"-Lorain Type "L" Engine.

THE "Oilwell"-Lorain Type "L" and Type "O" Engines are sturdy single-cylinder, two-cycle power units built to withstand hard continuous service and to require a minimum of attention. The overall design of these Engines is such that the number of working parts has been reduced to a minimum and the wearing parts are designed according to stationary-engine standards.

Condenser-type cooling system, large-capacity oil reservoir, and a combination forced-feed and oilbath lubrication system contribute to trouble-free operation. Enclosed disc-type clutch permits the use of standard V-belt sheaves. Control and service points are readily accessible. Large hand holes are provided at the crank end and adjacent to the crosshead.

The "Oilwell"-Lorain Type "L" and Type "O" Engines are adaptable to a wide range of oil-field applications since they are compact and weatherproof, and can be equipped to operate on either natural gas, butane or diesel fuel. A minimum of conversion parts permits easy and economical adaptation to a change in operating conditions without a reduction of horsepower.

SPECIFICATIONS

"Oilwell"-Lorain Engine		Type "L"	Type "O"
Bore	inches	7½	9½
Stroke	inches	8	10
Rating: At 300 r.p.m.	horsepower	10.7	21
At 450 r.p.m.	horsepower	—	32
At 600 r.p.m.	horsepower	21.4	—
Displacement	cubic inches	353	710
Rated Brake Mean Effective Pressure	p.s.i.	40	40
Diameter of Crank Pin	inches	4¾	5
Overall Height	inches	52⅞	59½
Overall Width	inches	47¼	57⅞
Overall Length	inches	70	87¾
Overall Length of Structural-Steel Skid Base Accessory	inches	72	96
Exhaust Connection (Pipe Size)	inches	4	4
Oil Capacity	quarts	10	25
Water Capacity	quarts	14	21
Shipping Weight: *Standard Equipment Only*: Domestic	pounds	2423	3700
Export	pounds	2723	4000
Complete with Steel Skid Base and Guard: Domestic	pounds	2916	4500
Export	pounds	3216	4900

OIL WELL SUPPLY COMPANY

Branches Serving All Oil Fields

Executive Office—Dallas, Texas
Export Division Office—
30 Rockefeller Plaza
New York 20, N. Y.

Division Offices—Casper, Wyoming
Columbus, Ohio . . . Dallas, Texas
Houston, Texas...Tulsa, Oklahoma
Los Angeles, California

UNITED STATES STEEL

"OILWELL"

SECONDARY RECOVERY

In the Rocky Mountains

By NAT A. SLAGTER
Lance Creek Unit Operators, Lance Creek, Wyoming

THE Rocky Mountain states of Colorado, Utah, Wyoming, Montana and northern New Mexico contain more than 120 oil and gas fields and several times as many separate reservoirs, or pools. The Lance Creek field, for example, is currently producing from seven different reservoirs. These fields as a group are characterized by steeply dipping structures with closures ranging from 100 to 5000 feet and generally over 500 feet. The different pools show a variation in reservoir characteristics as to reservoir material and contain fluid, and as to source of energy. The presence of an effective natural water drive is indicated in the majority of the reservoirs.

Time will not permit describing the individual pools here, nor would such information be of particular interest to this group. Your Secondary Recovery sub-committee is assembling the factual data on the various fields and this information will be available for reference when the work is completed. Reference will be made to reservoirs in the Lance Creek field for illustration. Lance Creek was selected for this purpose because it is the field with which the author is most familiar.

The term "secondary recovery" has been subject to different meanings. With a literal interpretation of the words, there would be very little secondary recovery in the Rocky Mountain region, because most such operations have been initiated during the primary lives of the reservoirs. The American Petroleum Institute publication on "Secondary Recovery of Oil in the U. S.," gives the following definition of secondary recovery:

"The oil, gas, or oil and gas recovered by any method (artificial flowing or pumping) that may be employed to produce them through the joint use of two or more well bores. Secondary recovery is generally recognized as being that recovery which may be obtained by the injection of liquids or gases into the reservoir for the purpose of augmenting reservoir energy; usually, but not necessarily, this is done after the primary-recovery phase has passed."

Presented before the Rocky Mountain District Meeting, API, June 25, 1947.

Successful programs, which do meet the requirements of this definition, are in operation in the Rocky Mountain states.

Water-Flooding

Water-flooding is a common type of secondary recovery in many eastern fields. Small parcels of a depleted and abandoned field are reworked by reconditioning old wells and drilling new wells on a definite and close spacing pattern. Water is injected into certain of these wells and oil is produced from others, usually fewer in number than the injection wells. This type of operation does not exist in the Rocky Mountain states and it probably never will be practiced on an extensive scale. Structural conditions would make any operation which was not on a pool-wide basis very difficult. Because of the lower price for crude and usually greater depth to producing sands, economic conditions would not justify duplication of the intensive development programs of the eastern fields.

Water injection has been tried in the Rocky Mountain district on an experimental basis, usually as an auxiliary to a natural water drive. We have no record of any material additions to Rocky Mountain oil reserves because of these operations.

Hydrostatic Reservoirs

Natural water drives are the principal source of energy in a major portion of the Rocky Mountain reservoirs. The time at which these drives become effective and the degree to which they are effective in maintaining formation pressures vary for different reservoirs, and they are not always the same in different parts of the same reservoir.

The Leo sand pool in the western part of the Lance Creek field is an example of this type of reservoir. First production was taken from this pool in September, 1937, when formation pressure was approximately 2000 pounds per square inch. During the first five years of operation the formation pressure declined about 400 pounds and during the second five-year period it declined only 100 pounds. Most of the decline in the second period occurred during the first three years of the period. Total withdrawal of oil and water during the second period was slightly greater than during the first period.

Approximately 2½ billion cubic feet of gas was injected into this reservoir from 1940 to 1945, 80 percent of which was injected during 1941 and the first half of 1942. The injected gas during this year and a half was approximately 35 percent of the produced gas. The injection of this gas did not materially change the rate of pressure decline. There is no evidence that the injection of gas added to the recoverable oil.

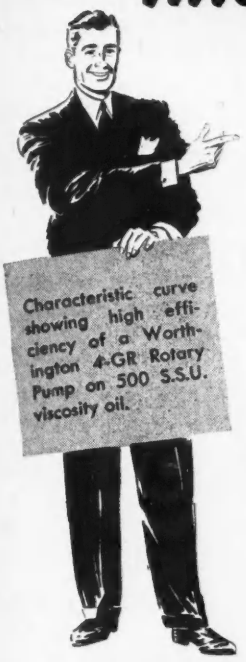
Present evidence does not indicate that gas or water injection will be of great value in reservoirs in which the native water drive is sufficiently early and active to maintain formation pressures at a major part of their original values. This statement applies only to the volume of oil recovery and not to the economics or mechanics of lifting the oil. The effect of any volume of water that could be injected on a practical basis would be of slight importance when compared with the force of the natural water drive in this type of reservoir.

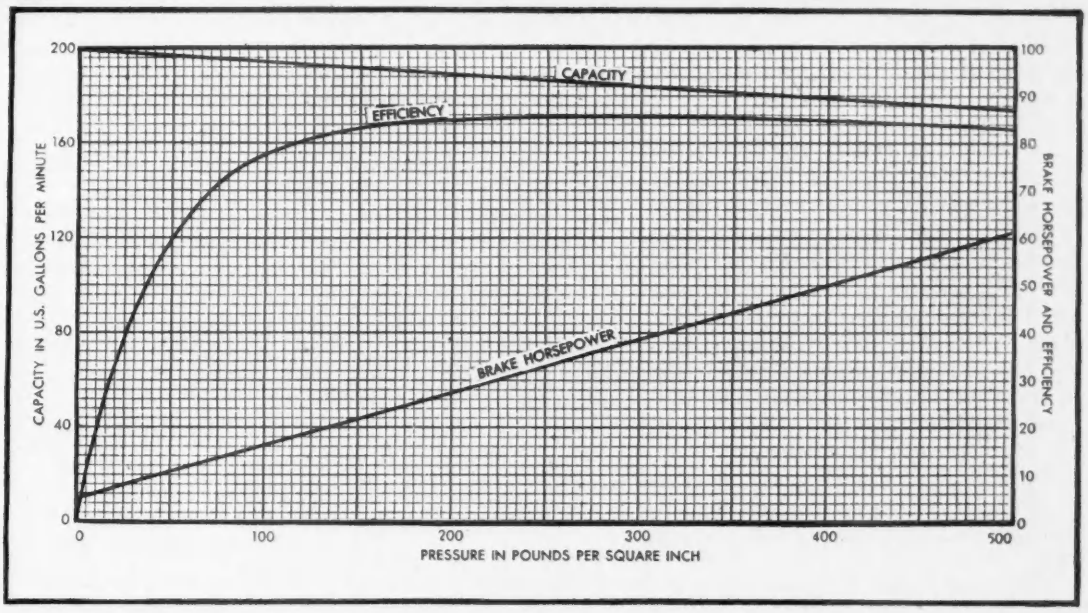
Proper control of production in the early stage of operation and the reduction of formation pressure by lifting substantial volumes of fluid in the later stages of operation are suggested as two means of increasing recoverable oil. It is realized that neither of these processes meets the requirements of the definition of secondary recovery quoted in this paper.

Control of the rate and location of withdrawals from hydrostatic reservoirs will result in a more uniform advancement of edge water, retard bypassing of edge or bottom water, and reduce the volume of oil trapped in the less permeable zones of the reservoir.

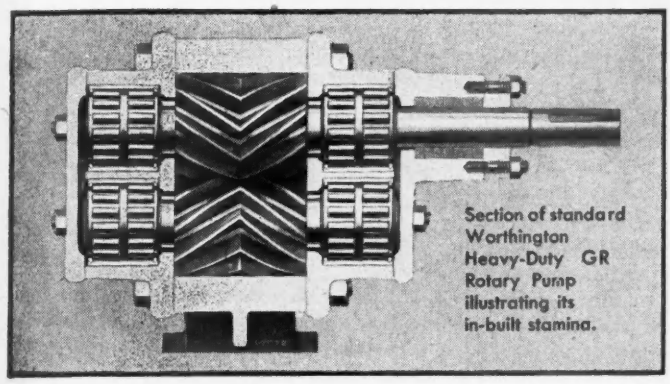
Reduction of formation pressure by the withdrawal of sufficient volume of fluid will permit part of the trapped oil to escape from the lower permeability portion of the reservoir rock. The amount of oil trapped in the reservoir will vary in the same order as the permeability. And this variation may be very great in many of the cal-

Imagine Performance Like This





IN A HEAVY-DUTY ROTARY PUMP



WHERE SUCH EFFICIENT PERFORMANCE COMES FROM

- Accurate machining and close clearances provide high suction lift and keep losses in capacity low
- Liquid flows freely through unobstructed passages in pump
- Double-helical gear rotors, free from axial thrust, prevent trapping of liquid between teeth
- Single stuffing box or seal, subject to suction pressure only, minimizes liquid leakage

When you get performance of the calibre charted above . . . and get it year after year . . . you're sitting pretty.

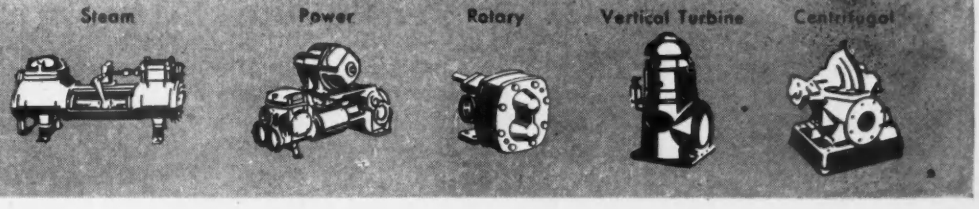
That's what you get from all 11 sizes of Worthington GR Rotary Pumps, covering displacements up to 5000 gpm at 500 psi. Their record in the oil fields, on the line, in refineries and in loading and distributing petroleum products backs up the chart.

You, too, can insure top performance in handling gasoline, crude, bright stock, grease, asphalts, tars, etc., by specifying Worthington GR Rotary Pumps. Available with steam or water jackets and with inboard bearings and mechanical seals for overhung drives. Bulletins W-487-B10B and W-487-B11 give all the facts that prove *there's more worth in Worthington. Worthington Pump and Machinery Corporation, Reciprocating Pump Division, Harrison, N. J.*

WORTHINGTON

P7-8

THE WORLD'S LARGEST MANUFACTURER OF PUMPS



careous formations. Feasibility of this type of operation will depend on the economic factors in the individual case. Value of the oil to be recovered, volume of fluid which must be produced, and the depth from which it must be lifted are a few of the factors which must be considered.

Successful secondary recovery operations are being conducted in the Rocky Mountain region in reservoirs in which internal gas drive serves as the principal natural source of energy. Reservoirs of this type constitute a minor portion of the total number, but they do include some of the most important ones. Natural gas has been the injection medium in most of these operations, although compressed air was used in one instance. Gas injection has been started at a different time in each pool, but in all cases it has been commenced before the primary phase was completed and the pool abandoned.

The basal Sundance sand pool in the west part of the Lance Creek field is an example of this type of reservoir in which pressure maintenance has been used. This pool was discovered in March, 1935, and a period of rapid development followed. A unit plan for the development and operation of this pool became effective January 1, 1938. Pressure maintenance, by the injection of gas into gas cap wells, was commenced in February of the same year. At that time formation pressure was slightly greater than half of its estimated original value of 1600 pounds per square inch.

Since the date of discovery, this pool has produced approximately 22½ million barrels of oil, 38 billion cubic feet of gas, and 350 thousand barrels of water from an area of about 1200 acres. About 25 billion cubic feet of gas and 24½ million gallons of butane and propane have been injected into the reservoir. The net gas production since pressure maintenance started has been about 4 billion cubic feet. Fifty-three wells were completed in this reservoir and 13 of these have been recompleted since in other sands. One well has been abandoned. Gas has been injected through 11 different wells, and generally five or six wells have been used for this purpose at one time.

Current production from 23 producing wells is 2200 barrels of oil, 9 million cubic feet of gas, and 225 barrels of water per day. Approximately 7 million cubic feet of gas and 25,000 gallons of surplus butane are being injected into the reservoir each day.

The initiation of gas injection during the early life of a pool, while formation pressures are still high enough to flow the wells, has several advantages in recovering what would have been the primary production. It permits the maintenance of a higher rate of production from a smaller number of wells with consequent economic gains. Lifting costs are reduced by flowing, instead of pumping, most of the oil. Natural gasoline and other liquid hydrocarbons are recovered at a faster rate and in greater total volume. And of particular importance, gas is conserved for use in the later recycling stages of operation.

The expansion of the gas cap in a pressure maintenance project produces a continuous increase in gas-oil ratio and decrease in producing well ratio. A point is eventually reached at which pressures must be lowered to avoid excessive operating costs and to prevent extreme reduction of oil-producing rates. Reduction of pressure and low pressure recycling should also result in the recovery of additional oil trapped in the less permeable portion of the reservoir by sustained pressure.

Water Drive Benefit

Possible benefits from the use of a water drive as an additional step in the life of a gas-cycled field should not be overlooked. Many factors peculiar to each reservoir will determine whether a water drive will be profitable. It is worth investigation and probably merits testing on an experimental scale.

Many of the problems presented by a water-flood operation are of little bother to the operator of a gas cap injection project. With gas as the injection medium, there is no need for a supply of injection water or the facilities for treating it. Well-spacing patterns, which have been the subject of much study in other areas, do not form a difficult problem here. Gas is commonly injected into any available gas cap wells. A uniformly spaced row of wells, around the structure and near the outer edge of the "oil ring," is of great importance. Proper location of wells does become difficult where faults or lithologic conditions have divided a field areally into many small reservoirs. Bypassing has not been a formidable problem in most fields. This is especially true where permeability is uniform and structure pronounced.

The development of a gas cap injection project in the Rocky Mountain region, on the other hand, is not without its own problems. These problems, which are not always of an engineering nature, may be very difficult.

Gas cap injection in fields with steeply dipping reservoir beds necessitates the operation of the entire reservoir as one unit. The formation of a unit operating agreement is a long and involved task. The difficulties which arise in securing the approval of all interests always delay the initiation of secondary recovery methods, and can obstruct it completely.

Gas from sources outside of the reservoir has been used to augment the produced gas for injection purposes in most Rocky Mountain projects. An available supply of cheap gas is, therefore, an important item in planning such an operation. Less outside gas will be needed when injection is started in the early life of the pool. Quite often this additional gas can be obtained from other reservoirs in the same field.

The shrinkage of the gas reserve is an item which requires the continuous attention of the operator throughout the life of the project. This shrinkage often equals 20 to 40 percent of the produced gas. If gas is recycled, the shrinkage occurs at each cycle. Part of the shrinkage is due to the extraction of natural gasoline and other liquid hydrocarbons. That part reduces the volume of gas available for injection, but it does not become a physical loss. Another importnat part is due to the use of gas as fuel for producing and treating oil, for extracting gasoline, and for compressing gas. Some gas is always lost through line leaks and breaks, and by blowing lines. Good operating practices will reduce this loss.

Increasing gas-oil ratios are always a problem in gas cap pressure maintenance programs. Ratios can be controlled by confining the producing wells to an ever-narrowing band around the reservoir. This practice, however, restricts the oil producing rate. The use of packers and other mechanical devices has proven successful in controlling gas-oil ratios in many cases.

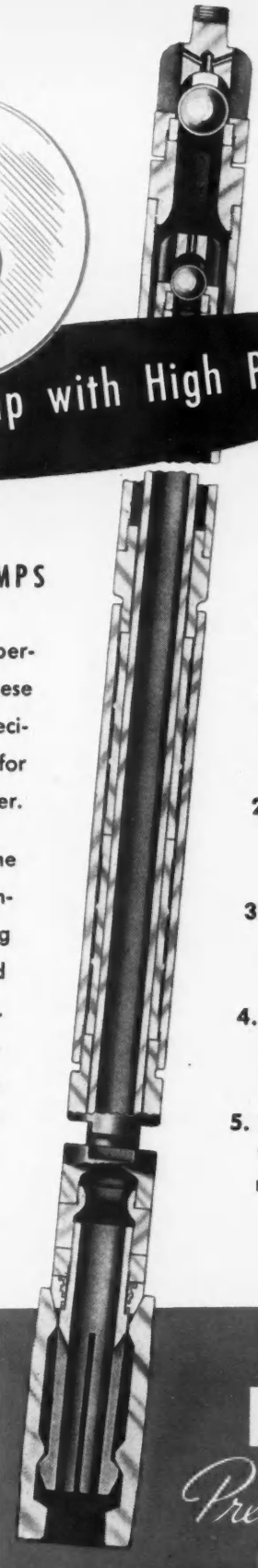
A large part of this paper has been devoted to gas injection projects because it is this type of operation which has been the most successful in the past and which promises to be most popular in the future in the Rocky Mountain region.

Since these gas injection operations have been started before the primary phase was completed and have not been carrier to the depletion stage, it is impossible to determine exactly what amount of oil would have been recovered by natural means and what amount to credit to secondary recovery methods. Modern technical methods do make it possible to calculate these values to a reasonable degree of accuracy. An examination of Rocky Mountain fields, on this basis, reveals that we may not be too optimistic in expecting increases in oil recoveries of 50 to 100 percent as the result of properly conducted secondary recovery operations of the gas injection type, in reservoirs where they are applicable.

The success of these operations is attested by the recent public announcement that several million dollars will be expended for the erection of a gas processing and recycling plant in the Elk Basin field.

MORE VALUE for your Pumping Dollar!

An Economical Plunger Pump with High Pumping Efficiency



PACIFIC'S OIL STATES R.L.T. PUMPS

Pacific Oil States Pumps meet and often surpass performance records of more expensive oil well pumps. These pumps are of a simple construction, conform to API specifications and built to the high standards of precision for which Pacific Pumps are known the world over.

The Oil States R.L.T. Pump is so constructed that the barrel, with its precision honed Moloy Liners connected through an extension tube to the traveling valve on top, reciprocates with the sucker rod actuation over the precision ground plunger. Special alloys, plus precision workmanship provide "Pacific's Metal-to-Metal Seal," reduce losses from friction and fluid slippage and give high pumping efficiency. Because of this, faster stroking is possible and more production can be obtained with low power consumption.

Besides operating economy, maintenance costs are kept low by the plunger and liner regrinding service offered by Pacific. As many as five pump runs with a single pump at a fraction of the replacement costs are possible with this service. Consult your nearest Pacific representative for full details.

OUTSTANDING FEATURES OF ALL PACIFIC PUMPS

1. ***Metal-to-Metal Seal:*** Reduces pump friction and loss of fluid from slippage.
2. ***MOLOY Liners:*** Allow small clearances: eliminate galling, resist abrasion and corrosion.
3. ***"Streamlined" Cages and Fittings:*** Reduce ball spin, turbulence and friction.
4. ***Hardened Stainless Balls and Flat Type Seats:*** Eliminate seat distortion; assure leak-proof sealing.
5. ***Precision-Finish Plungers:*** Permit extremely close running clearances; reduce pump friction and wear.

PACIFIC
Precision Built
PUMPS

PACIFIC PUMPS, INC. **HUNTINGTON PARK, CALIFORNIA**
One of the Dresser Industries
Mid-Continent Division: 915 E. Second St., Tulsa, Oklahoma
Export Office: Channin Bldg, 122 E. 42nd St., New York, N.Y.

Condensate PRODUCTION AND CYCLING

By PARK J. JONES
Consultant

Part 9

Injection of Gas Into Water

THE breakthrough area for gas injected into water is greater than that for gas injection above a water contact. This is the chief advantage for injecting gas on the downdip side of the water contact in a condensate reservoir. However, if the difference between a bottom-hole injection and a reservoir pressure be nominal, density difference between water and gas may drastically limit the relative rate of gas injection into the lowest bed. Either two rows of gas injection wells or dual injection completions on one row are required for gas injection into water under certain conditions.

Displacement of Water by Gas

Consider injection of gas below a water contact in a rich gas reservoir. Let the water-bearing media have characteristics for which the interstitial water content would be I percent of porosity if the media were a gas pay. Denote the water initially in place within the (1 — I) fraction of porosity by unity and call it displaceable water.

Force gas into a uniformly-permeable water section. The cube root of the relative permeability K_w to water and the square root of the relative permeability K_g to gas are defined[1] approximately by the lines in Figure 9-1. The indicated data are for 20 percent non-displaceable water.

Figure 9-2 shows the relative permeability to gas and water in uniformly-permeable sections for which either 10 or 40 percent of the water is non-displaceable.

The data of Figure 9-1 are replotted in Figure 9-3 against displaced water C expressed as a fraction of displaceable water. Relative permeability to water is given approximately by

$$K_w = (1 - C)^3 \qquad (1)$$

and to gas by

$$K_g = 1.23\,(C - 0.1)^2 \qquad (2)$$

Volume Percent Gas

Let Q_w be the rate of water production from a uniformly-permeable section and Q_g, the rate of gas production. Both rates are measured at reservoir pressure and temperature. The volume fraction G of gas in production is defined by

$$G = \frac{Q_g}{Q_g + Q_w} = \frac{1}{1 + \frac{Q_w}{Q_g}} \qquad (3)$$

The rate of production of a given fluid from a section varies directly with the relative permeability to the fluid and inversely with the viscosity of the fluid. Accordingly, the volume fraction gas in the production from a uniformly-permeable section is defined approximately by

$$G = \frac{1}{1 + \frac{\mu_g}{\mu_w} \cdot \frac{(1 - C)^3}{1.23\,(C - 0.1)^2}} \qquad (4)$$

The curves in Figure 9-4 are solutions of equation (4). The water displaced from a uniformly-permeable section is plotted against volume percent gas for 20 and 80 water-gas viscosity ratios.

Volume Percent Water

The volume fraction W of water in the production from a uniformly-permeable section is given by

$$W = \frac{Q_w}{Q_w + Q_g} = \frac{1}{1 + \frac{Q_g}{Q_w}} = \frac{1}{1 + \frac{w}{g}\,\frac{K_g}{K_w}}$$

and by

$$W = \left[1 + \frac{\mu_w}{\mu_g} \cdot \frac{1.23(C - 0.1)^2}{(1 - C)^3}\right]^{-1} \qquad (5)$$

Gas Requirements

Let G_o represent the cumulative gas production expressed as a multiple of the displaceable water initially in place. The increase dC of cumulative water from a section divided by the increase in total production d (C + G_o) is the fraction of water in production, that is,

$$\frac{dC}{d(C + G_o)} = W$$

and

$$C + G_o = \int \frac{dC}{W} \qquad (6)$$

Upon substituting the right side of equation (5) in (6), we have

$$G_o = 1.23\,\frac{\mu_w}{\mu_g} \int_0^C \frac{(C - 0.1)^2}{(1 - C)^3}\,dC$$

from which

$$G_o = \frac{\mu_w}{\mu_g}\left[\frac{1.72C^2 - 1.22C}{(1 - C)^2} - 1.23\,\log\,(1 - C)\right] \qquad (7)$$

where log is the natural logarithm. The total gas requirement in barrels at reservoir conditions per barrel of displaced water is given by (1 + G_o/C).

The curves in Figure 9-5 show the total gas requirements for a uniformly-permeable section and viscosity ratios of 20 and 80. Displaced water, in percent of displaceable water, is plotted against the total volume of gas into a section. The latter is in barrels, measured at reservoir pressure and temperature, per barrel of displaced water.

Gas-Water Ratio

Let R be the gas-water ratio for the production from a uniformly-permeable section. At reservoir conditions,

$$R = \frac{Q_g}{Q_w} = \frac{\mu_w}{\mu_g} \cdot \frac{1.23(C - 0.1)^2}{(1 - C)^3} \qquad (8)$$

The volume factor B for gas in barrels per Mcf of gas is defined by

$$B = 5.04TZ/P$$

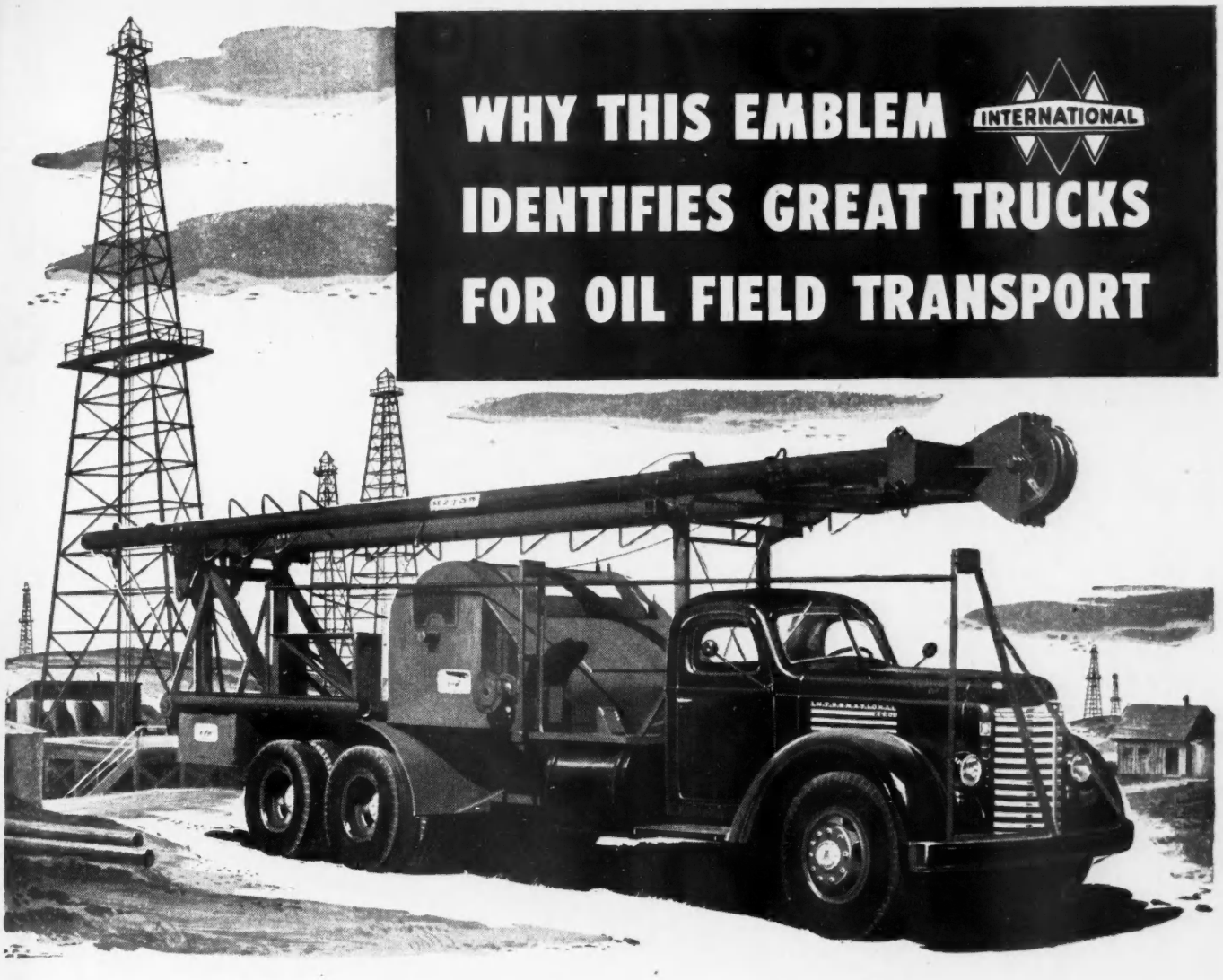
Accordingly, the gas-water ratio in standard cubic feet of gas per barrel of water is given approximately by

$$R = \frac{244P\mu_w}{TZ\mu_g} \cdot \frac{(C - 0.1)^2}{(1 - C)^3} \qquad (9)$$

The first expression on the right side

WHY THIS EMBLEM IDENTIFIES GREAT TRUCKS FOR OIL FIELD TRANSPORT

INTERNATIONAL



International Trucks from the smallest to giant six-wheelers—from half-ton pickups to huge "Oil Field Specials" built at International's Emeryville, Calif., plant—are busily at work every day throughout America's great oil industry.

These trucks demonstrate every day the reason why the famous International Triple Diamond Emblem identifies great trucks—greatness that is designed in, engineered in and built in.

Take these two six-wheelers as examples—the KB-8-F and the KB-11-F—two of 15 New International KB Models.

The KB-8-F has a gross weight rating of 27,000 pounds. It is available in four wheelbases: 161, 179, 197 and 215 inches. It is powered by the famous International Red Diamond 361 Engine, which develops 126 brake horsepower at 3000 r.p.m., and 282 pound feet of torque at 1200 r.p.m. If greater power is required, the International Red Diamond 401 Engine is available.

The KB-11-F has a gross weight rating of 37,000 pounds. It is available in three wheelbases: 161, 197 and 215 inches. It is powered by the International Red Diamond 450 Engine, which develops 148 brake horsepower at 2600 r.p.m. and 360 pound feet of torque at 1000 r.p.m.

For every oil field transport job there is a rugged, dependable, economical International of the right size, type and power. For details consult your International Dealer or Branch.

40th ANNIVERSARY OF INTERNATIONAL TRUCKS

1907-1947—Forty Years of International Truck Service to Commerce, Industry and Agriculture

INTERNATIONAL TRUCK SERVICE

Top quality, expert and economical! Quickly available everywhere from thousands of International Dealers and the nation's largest company-owned truck-service organization—International Branches.

Motor Truck Division

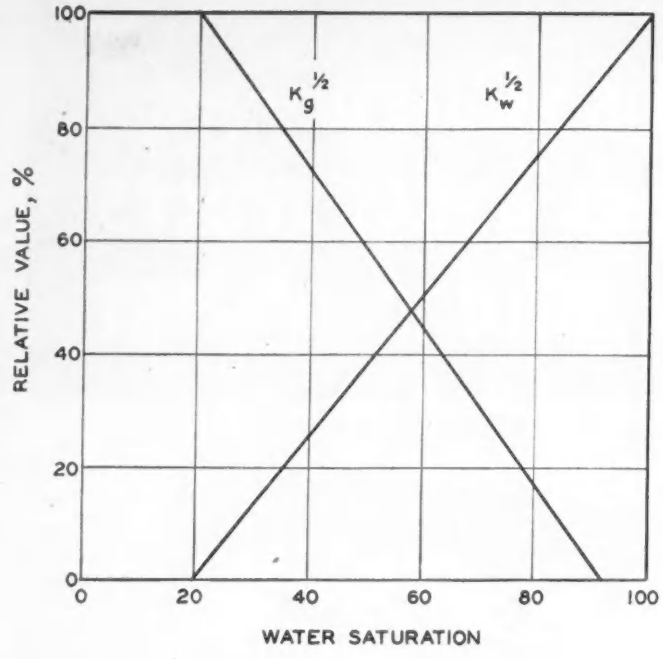
INTERNATIONAL HARVESTER COMPANY

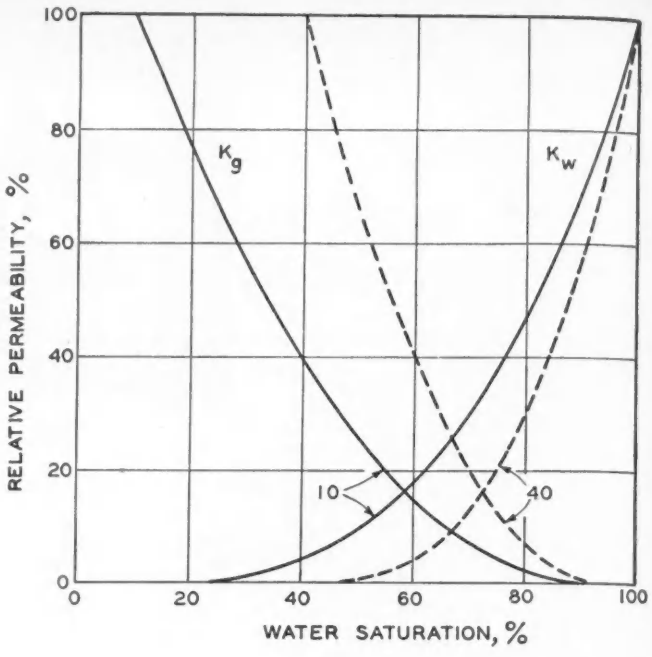
180 North Michigan Avenue
Chicago 1, Illinois

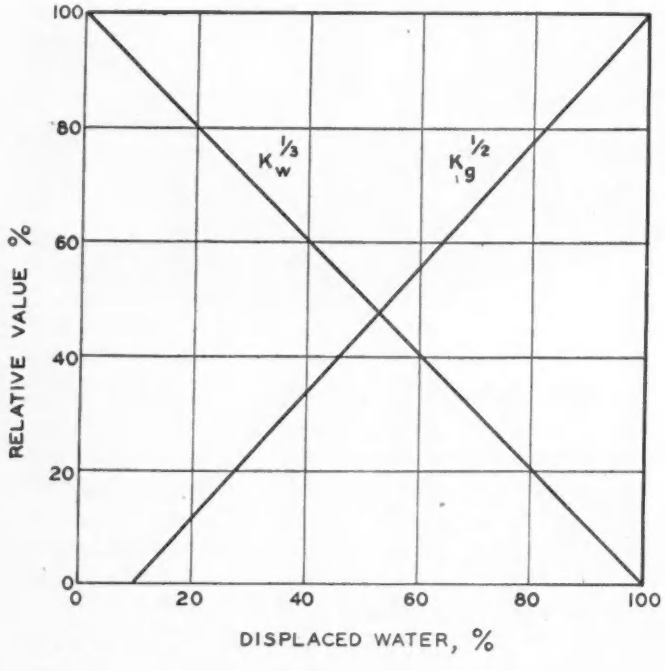
Tune in James Melton on "Harvest of Stars" Every Sunday! NBC Network.

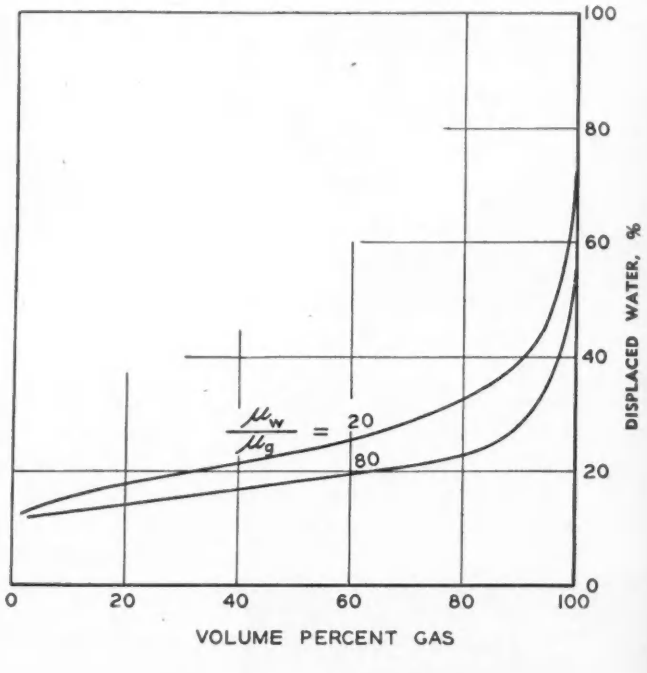
INTERNATIONAL

INTERNATIONAL *Trucks*









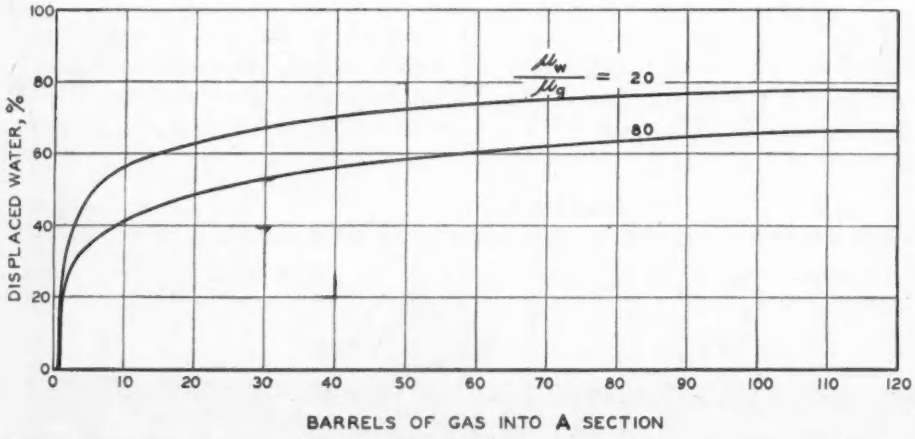


Figure 9-5. Barrels of gas required to displace one particular barrel of water from a uniformly-permeable section of a 20- or 80-viscosity ratio.

Figure 9-1 (top left). Cube root of relative permeability to water and square root of relative permeability to gas vs. the water displaced from a uniformly-permeable section for 20 percent non-displaseable water.

Figure 9-2 (top right). Relative permeability for displacement of water by gas from a uniformly-permeable section vs. water saturation for either 10 or 40 percent non-displaceable water.

Figure 9-3 (center left). Cube root of relative permeability to water and square root of relative permeability to gas vs. displaced water in percent of displaceable water.

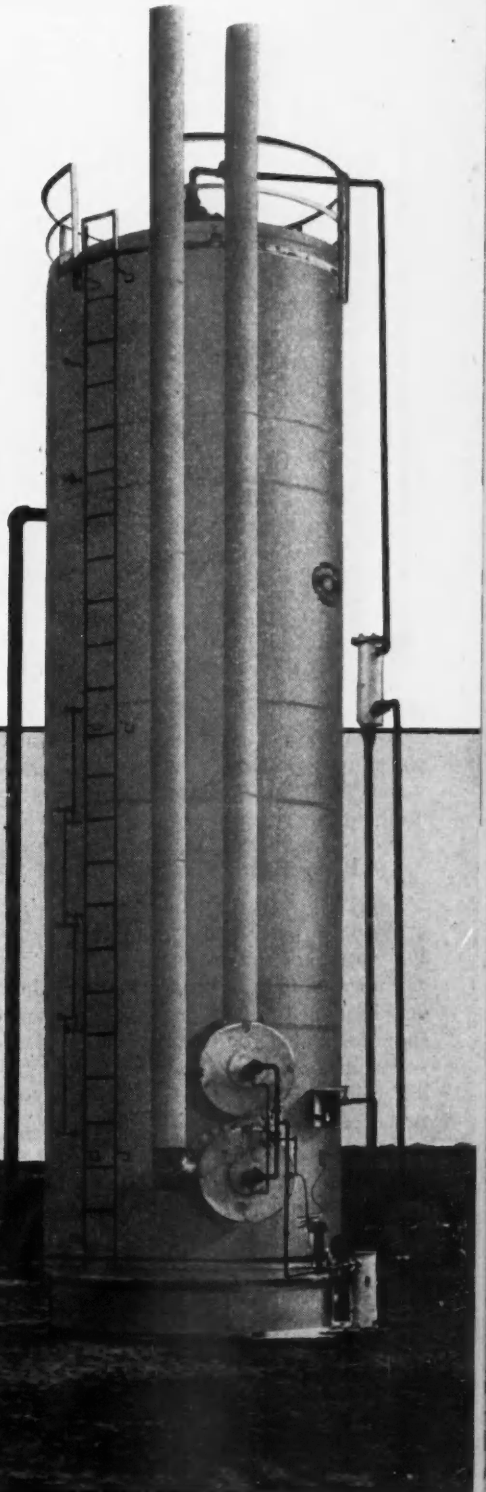
Figure 9-4 (center right). Displaced water vs. viscosity ratio and volume percent gas in the production from a uniformly-permeable section.

PARKERSBURG *Self-Insulating* EMULSION TREATERS

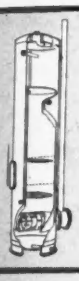
Longer *Fire-Tube* Life

than any other Treater!

Yes, the *exclusive* combination radiation and convection heating principle employed in the design of Parkersburg Treaters distributes heat throughout the full length of the heating tube and results in longer life for the fire tube . . . *plus* better heat distribution . . . *plus* new fuel economies. This new heating principle is another of the many reasons why more operators than ever before have turned to Parkersburg Self-Insulating Treaters to handle their toughest emulsion treating problems. Parkersburg Treaters have proved the most efficient, dependable and economical treater on the market today. Talk to your Parkersburg Representative about how *superior* Parkersburg Treaters are solving problems in field after field.

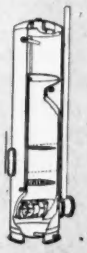


Plus 6 More Reasons For Parkersburg Superiority . . .



Acts as separator, settling tank, heater and treater. (Exclusively Parkersburg).

Twice as much oil settling space as some similiar types of treaters.



Heating element (exclusively Parkersburg) 100% proofed against hot spots and scale deposits.

Preheats emulsions (exclusively Parkersburg) to assist in breaking down emulsions without additional outside equipment.

Improved Mist Extractor (exclusively Parkersburg) scrubs gas and returns condensate to mixing compartment . . . saves rich vapors that maintain gravity of oil.

Self-Insulating (exclusively Parkersburg) . . . provides greater efficiency and economy in use of fuel . . . maintains constant temperatures, unaffected by outside weather conditions.

THE PARKERSBURG RIG & REEL C

PARKERSBURG & OCS PRODUCTS

GENERAL OFFICES, PARKERSBURG, W. VA.

Plants at Parkersburg, W. Va., Coffeyville, Kan., Houston, Texas

District Offices:

Dallas : Houston - Los Angeles - Tulsa - New York

THE PARKERSBURG RIG & REEL CO. 50th ANNIVERSARY 1897-1947 PARKERSBURG, W. VA.

PARKERSBURG

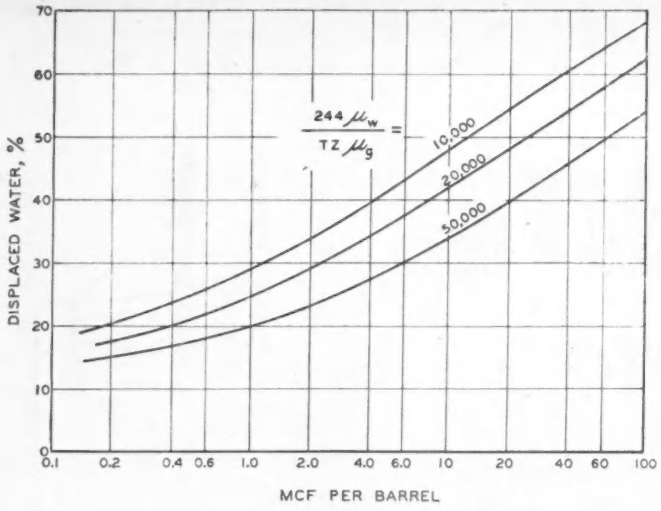


Figure 9-6. Gas-water ratio vs. pressure-fluid factor and water displaced from a uniformly-permeable section.

is the pressure-fluid factor F for displacement of water by gas. The usual value of F falls between 10,000 and 50,000. As an example, consider a 400 and a 6000 psia reservoir pressure and the following:

P	T	μ_w	μ_g	Z	F
400	550	1.0	0.012	0.94	15,700
6000	700	0.6	0.030	1.10	38,000

The curves in Figure 9-6 are solutions of equation (9). Cumulative water displacement is plotted against the gas-water ratio in the production from a uniformly-permeable section.

Pressure for Gas in Water

Let ∇P_g and ∇P_w be the pressure gradients for gas and water respectively. For instance, the pressure gradient for gas may be 0.08 pounds per square inch per foot of gas. Whereas, the corresponding value for the water in a reservoir may be 0.48 psi/foot of water. The difference or 0.4 would be the gravitational pressure gradient for gas in water.

When gas is injected into water, the density of the gas in a well offsets the density of the gas outside of the well provided the latter is above water, see Figure 9-7. Let ΔP_g be the build-up, that is, the difference between reservoir and injection bottom-hole pressures. The pressure difference does not vary with depth for gas injection into dry gas. However, the pressure difference for injection gas into water decreases at the rate of $(\nabla P_w - \nabla P_g)$ psi per foot of depth in water.

The influence of gravity on the per-interval relative rate of injection is significant for small buildups. A 30 psi buildup, for example, and a 0.4 gravitational pressure gradient in 50 feet of water section would have a 30 psi pressure difference for the top perforations and [30 — 50(0.4)] or only 10 psi for the bottom perforations. Gravity would reduce the rate of injection into the bottom perforations to one third of what the rate would be aside from gravity. On the other hand, if the buildup for the top perforations were 300 psi, the corresponding value for the bottom would be 280 psi.

Gravitational pressure gradients displace gas upward and tend to spread it out along strike as a layer above water. In addition, the component of a gravitational pressure gradient parallel to bedding causes a layer of gas to migrate updip. The pressure difference tending to displace gas upward is $0.433(\Delta S)h$ where ΔS is the difference in specific gravity and h is the distance below a gas-water contact.

Consider injection of gas into a water-bearing bed for which the dip is D degrees in the vicinity of an injection well. Let h be the difference in elevation between the up and downdip ends of the gas in a bed. The gravitational pressure difference acting parallel to bedding in the updip direction is defined[1] by

$$\frac{\Delta P}{W} = 0.433(\Delta S)h \sin D \cos D \qquad (10)$$

where $\Delta P/W$ is the gravitational pressure difference per unit width at right angles to the direction of dip, that is, gravitational migration is at right angles to structural contours. The gravitational pressure difference $0.433(\Delta S)h$ multiplied by sinD is the dip component of gravity. CosD projects vertical area on a plane at right angles to bedding.

The invasion factor, aside from gravity, for injection wells located on the downdip side of a water contact is defined[2] by

$$I = 1 - \left(\frac{2}{N+2}\,\frac{R}{D}\right)^N \qquad (11)$$

where
D = distance from producing well to injection well, feet
R = distance from producing well to product limit, feet
N = 360/A
A = angle, degrees.

For instance, let an injection well be located at 1.2 times the distance from a producing well to a rich gas-water contact. Let the angle A of the sector allocated to the well pair be 45 degrees. Then N equals eight and the breakthrough invasion factor is about 92 percent of the acre-feet within the breakthrough interval for the sector allocated to the well pair.

Equation (11) also defines the invasion factor in the breakthrough interval for injection of gas into water where the area of the sector between lines of symmetry is less than the area that would be invaded aside from the lines of symmetry. The per-sector angle for reservoir having six or more injection wells is 60 degrees or less. The flow lines for one well pair would extend beyond the limits of 60-degree lines of symmetry if the latter were not present. Therefore, equation (11) defines the breakthrough invasion factor for a reasonable number of injection wells in water.

A small reservoir, however, may have only one injection well in water. In this case, gravity limits the width of invasion patterns. The area of the pattern is not known definitely but is not likely to be less[1] than the area of a 70 percent breakthrough pattern, see part 4, provided the productive limit is a rich gas-water contact at all points within a 70 percent pattern. Where a portion of a productive limit is an impermeable boundary, discount the breakthrough area by the methods in Part 4.

REFERENCES

[1] Jones, Park J., Vol. I, Mechanics of Production, Reinhold Publishing Corp., New York, 1946.
[2] Hensley, Harold L., The Oil and Gas Journal, May 3, 1947.

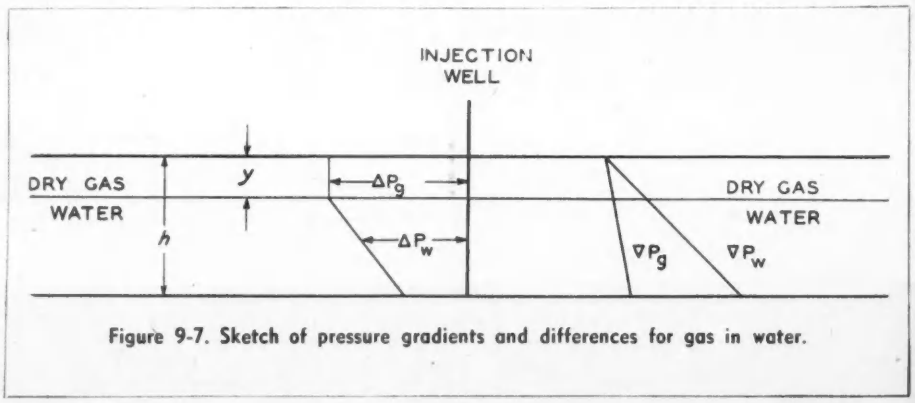


Figure 9-7. Sketch of pressure gradients and differences for gas in water.

Counter Clockwise: Model E Double Drum Winch Tractor. Model E Double Drum Winch Tractor with 2 pole telescoping mast and spudding equipment. Model E Double Drum Tractor-Spudder. Maximum Line Pull of Model E Units is 54,700 lbs. Maximum Line Speed is 1,074' p.m.

A-C Model E Tractor Units are rolling again!

For the first time in several years the materials to build Allis-Chalmers—Fred E. Cooper Model E WINCH TRACTORS are being received in increasing quantities.

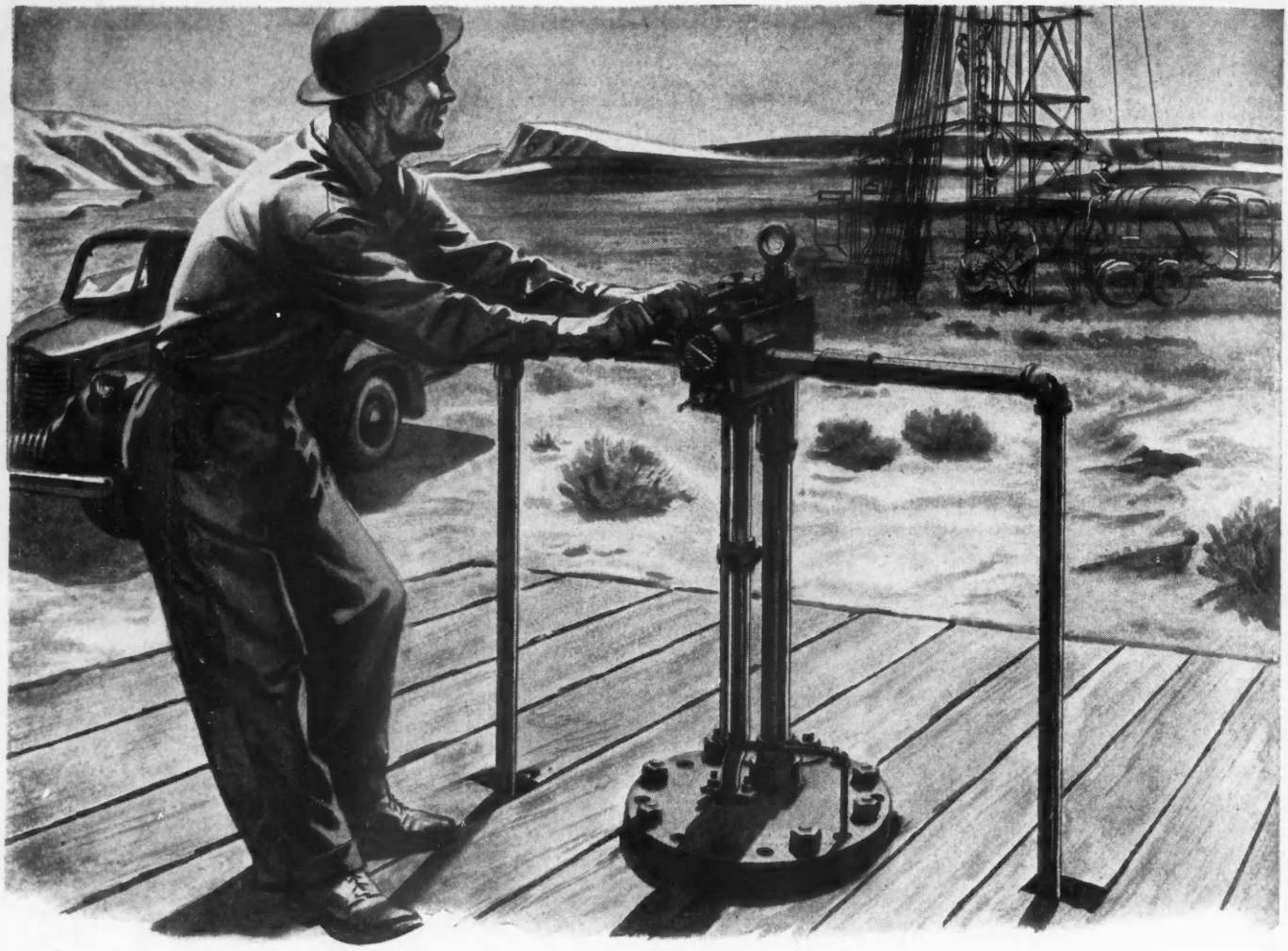
There is every reason to believe, unless further delays are experienced, that production and deliveries on pre-war schedules will be attained within a reasonable period. Units on backorder are now being shipped the day completed.

The Cooper well-servicing engineer in your district will be glad to discuss your well servicing requirements and submit his recommendation.

FRED E. Cooper, Inc. TULSA, OKLA.

Phone 5-7191 P. O. BOX 1890

Branches — HOUSTON — Ph. Fairfax 4619 LYNWOOD, Los Angeles — Ph. Newmark 24747



THE POWER OF 1 MAN INCREASED 64 TIMES to Lower the Costs of Oil

One man now can do in half an hour the work formerly done by four men in eight hours. A 64 to 1 saving.

This results from an invention by Dresser Industries, through its member company, Kobe, Inc. An oil well pump which brings itself to the surface for servicing! This saves the cost of pulling from 3,000 to 10,000 feet of pipe and later running that same pipe back in the well.

The cost of periodically pulling up an ordinary pump from the bottom of a well is about 25% of total pumping costs. The new Kobe pump wipes out this expense. Skeptics please note—figures given are very, very conservative. Write for specific data and records of Kobe Free Type Pumping.

New, spectacular engineering on behalf of the several industries it serves—such as this labor-saving pump for oil producers—is the specialty of Dresser Industries, Inc., Terminal Tower, Cleveland 13, Ohio.

Creative Engineering FOR INDUSTRY

with special emphasis on oil, gas and chemistry

DRESSER INDUSTRIES, INC.

BOVAIRD & SEYFANG Mfg. Co.
Bradford, Pa.

BRYANT Heater Company
Cleveland, O.; Tyler, Tex.

CLARK Bros. Co., Inc.
Olean, New York

DAY & NIGHT Mfg. Co.
Monrovia, Calif.

DRESSER Mfg. Division
Bradford, Pa.

DRESSER Mfg. Company, Limited
Toronto, Ont., Canada

INTERNATIONAL Derrick & Equipment Co.,
Columbus, Marietta & Delaware, Ohio;
Beaumont, Texas; Torrance, Calif.

KOBE, Inc.,
Huntington Park, Calif.

PACIFIC Pumps, Inc., Huntington Park, Calif.

PAYNE Furnace Co., Beverly Hills, Calif.

ROOTS-CONNERSVILLE Blower Corp.
Connersville, Ind.

SECURITY Engineering Co., Inc.
Whittier, Calif.

STACEY BROS. Gas Construction Company
Cincinnati, Ohio
Stacey-Dresser Engineering Division
Cleveland, Ohio

ELECTRIC POWER in Water-Flooding

By B. F. THOMPSON
Electrical Engineer

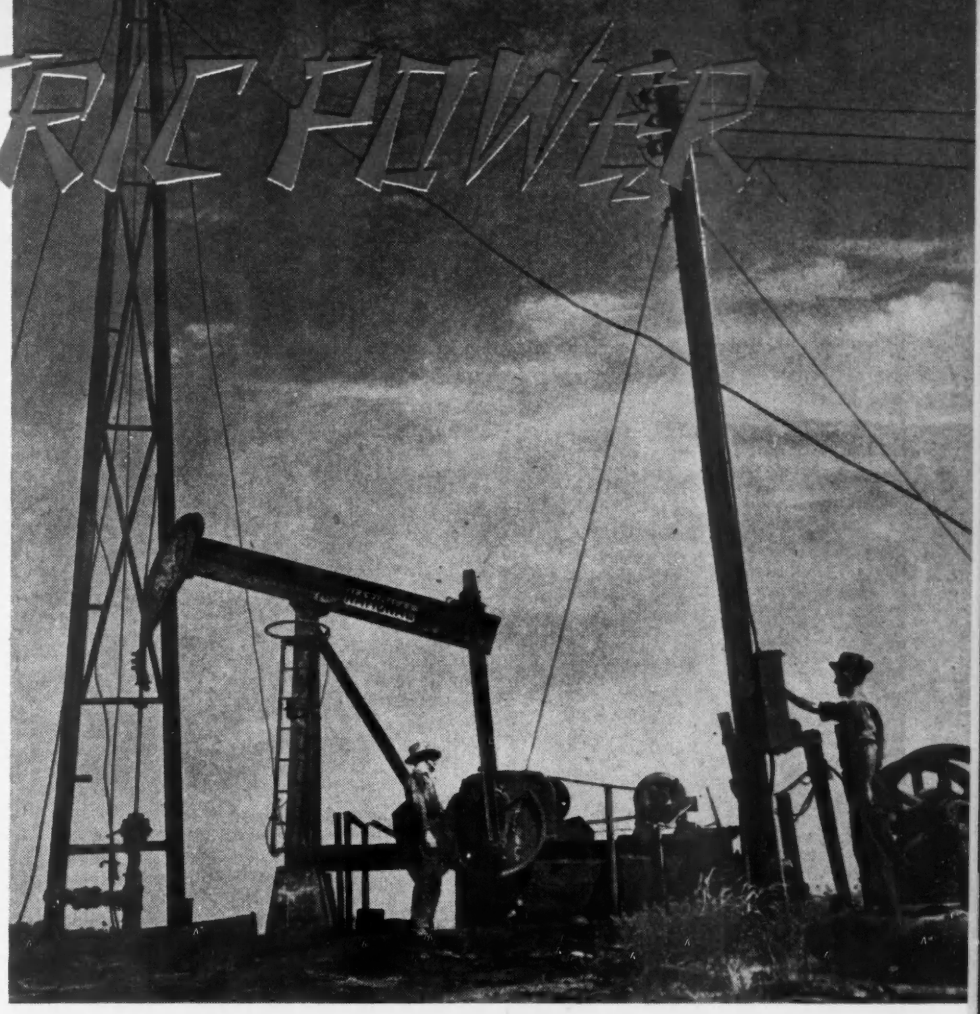


Figure 1. The Electrically-driven water well producing subterranean flood water is no different in appearance from the oil-producer with similar above-ground equipment. Lease power lines are of the three-phase, 440-volt type, carried on polls which also serve as control mountings.

EXTENSIVE application of electric power in water-flooded operations in the Nowata area of northeastern Oklahoma emphasizes the trend towards more modern and efficient practices on marginal leases where operating costs must be most closely watched in order to show a profit.

In that area electrical installations not only have reduced operating costs but have greatly improved the general aspects of leaseholds and also have helped to reduce accident frequency among personnel. Good "lease housekeeping" has important psychological effects on both worker and owner who are inclined to operate better than on a lease cluttered with rusted and useless equipment. The almost universal use of electrical energy for practically all operations at Nowata has resulted in neat-looking installations which give the appearance of prosperity and efficiency.

A check in the area reveals that approximately 80 percent of the acreage under flood is using electric power for all operations and practically every operator is using electric power to some extent. Although some individual operators generate their own juice the majority are hooked to nearby power lines. One operator reported that he found it more economical to buy power and cited his own experience to prove his point. He said that for years prior to his present installation he generated his own power. When the generator broke down, a check of costs revealed that it had been using approximately 20 gallons of oil every 24 hours. It was decided to connect with a power line and use the generator as a standby. This has resulted in an average saving of about $25 a month.

In the Nowata area, installations usually use three-phase 440-volt service, generally an oil field standard. Motors are of the standard squirrel cage type, an economy over the more expensive wound motor or synchronous motor. In general, open-type motors are used when they are located indoors, and splashproof or fully-enclosed motors when they are outdoors. Control and protective equipment on most motors consists of a magnetic contractor with heater type overload relays and a fused switch. Time clocks for starting and stopping, and some types of automatic control through pressure switches or flat switches are installed where their need is indicated.

Contact Push Buttons Used

A departure from ordinary practice is the rather general use of maintained contact push buttons on the magnetic contractor. The ordinary type of start-stop push button, in addition to starting and stopping the motor also serves as a low voltage release. That is, if the power supply is interrupted for any reason, the motor stops and will not restart itself. In many water-flood applications this is very undesirable, as continuous operation is of the greatest importance to the operator, since many motors are

NOTABLE PROGRESS has been made in the electrification of secondary-recovery operations in the old Nowata, Oklahoma, water-flood area, one of the largest in the country. Ample facilities and moderate power rates have prompted operators to install electrical equipment on a wide scale. A recent survey of the field shows that approximately 80 percent of the acreage under flood is completely electrified while practically every operator is using electric power to some extent. The wide application of electricity in pumping and other operations not only has resulted in increased efficiency and economy but also has resulted in neat and attractive leaseholds.

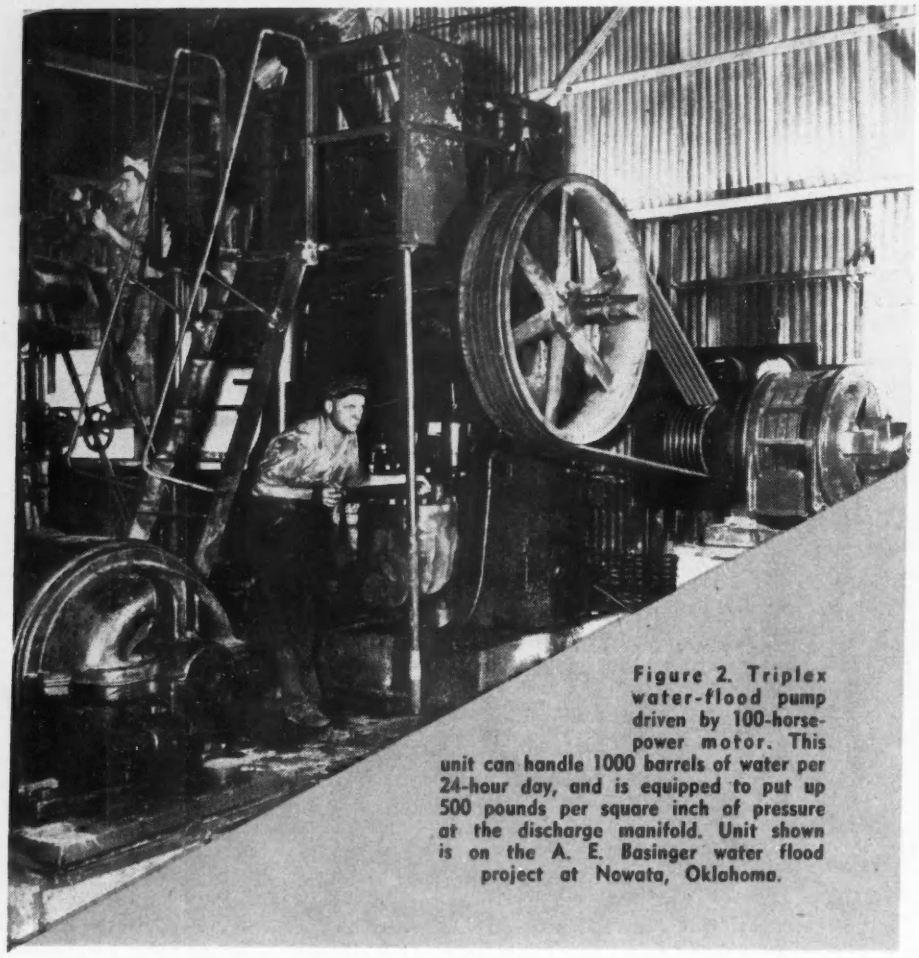


Figure 2. Triplex water-flood pump driven by 100-horsepower motor. This unit can handle 1000 barrels of water per 24-hour day, and is equipped to put up 500 pounds per square inch of pressure at the discharge manifold. Unit shown is on the A. E. Basinger water flood project at Nowata, Oklahoma.

left unattended, or scattered over the lease so that the time and labor required in restarting is considerable. Use of the maintained contact type of push button removes this difficulty, as the motor will then restart itself when power service is restored. Most power systems are subject to voltage surges and momentary interruptions during storms of sufficient length to stop motors with low voltage releases; and the number of these short-time interruptions usually greatly exceeds the number of long-time interruptions. Use of the maintained contact buttons thus makes for much more continuous service, since it eliminates shut downs from these brief interruptions.

Avoiding Trouble

However, in the use of maintained push buttons on the magnetic contractor, electrical engineers point out that several things must be watched if trouble is to be avoided. First, the motor should be able to start under full load, but as this generally is true in water-flood applications, it seldom is a factor. Second, the heater relays must be of the proper size to protect the motor, as they will be used to disconnect the motor from the line in case power service phases when it is restored. This point should be watched carefully as a general protective measure, but particularly so on an unattended motor with the maintained contact control. Third, the power supply system must have sufficient capacity to start at one time all the motors equipped with the maintained contacts. In the Nowata area operators generally have been able to use the maintained contact on the smaller leases, and on the larger ones for at least the unattended motors. At least one manufacturer makes an adjustable time delay relay which can be used to restart motors after an interruption in a definite length of time up to two or three minutes, and through use of this any lease can be restarted automatically after an interruption. Its use should be considered in any new installation.

In connection with the use of electrical energy for water-flood operations, the following specific applications and details should prove of interest to operators not alone at Nowata but also in other areas where marginal leases are being subjected to flooding.

Generally, the largest and most important motor on a flood is the one operating the pressure pump. If a piston or plunger pump is used, belted connection using V belts and as high speed a motor as practicable is probably the most satisfactory method of application, as with this the pump speed may be varied by changing pulleys to suit varying water requirements.

With this type pump the only method of regulation is through bypassing, and as it costs as much to pump bypassed water as it does to pump useful water, it is important for efficient operation to run the pump to deliver as close to the actual water requirements as possible. As water requirements are practically the same from day to day, this usually can be done with little trouble.

Where a centrifugal pump is used, motors usually are direct-connected on a base furnished by the pump manufacturer.

Centrifugal vs. Plunger Pump

Choice of a centrifugal or plunger pump for use on this service is largely determined by other than electrical conditions. However, for the ordinary run of pressures around 500 pounds per square inch and deliveries of 10,000 barrels per day or less, the plunger pump usually will be the most efficient and will require the least power for operation, even allowing for a moderate waste through the bypass. In addition, if it is found necessary and desirable to change the operating pressure or delivery after the plant is started, this is much more easily done with a plunger pump as a centrifugal pump usually requires a change in speed, a change in impeller sizes, or sometimes both, if efficient operation is to be maintained.

Raw water supply in the Nowata area is mostly obtained from the Verdigris River. Two types of pumps are used: ordinary centrifugal pumps, mounted on an inclined platform and connected to the intake and discharge lines with rubber hose so that the pump can be raised and lowered to accommodate varying levels of water in the river, and vertical turbine pumps, mounted on platforms with the pump at low water level. Both types take about the same power for operation. Controls usually are arranged for unattended operation. One operator uses a time clock for automatic control; others start and stop the motor with a switch in their plant; and some have an operator to inspect the motor occasionally and start and stop it when necessary. Two operators obtain their raw water from wells, pumping it with beam pumps, using a belt-connected electric motor.

Miscellaneous pumps around the water plant such as backwash, pickup, etc., are usually centrifugal . . . belted or direct connected. Operators have learned that for efficient operation these should be carefully selected to fit the job they are to do. A centrifugal pump will work

and deliver water at a wide range of pressures but it will do it efficiently only when operated near its design point. That is, a pump designed to deliver 100 gallons per minute at 100 pounds pressure may deliver 200 gallons per minute at 50 pounds pressure, but may take twice as much power as a pump designed to deliver the 200 gallons per minute at 50 pounds pressure.

Oil wells are pumped satisfactorily either from central powers or with individual jacks. The individual jack with an electric motor controlled by a time clock is the favorite for new installations as it is very flexible; speed and time of operation can be easily varied to suit the individual well. Through the use of the time clock the well may be pumped any length of time desired and very little maintenance is necessary, so that one pumper can care for a large number of wells.

Numerous central powers are used and do a good job for a power cost not much more than individual jacks, where rod lines are well greased and maintained, and proper attention is paid to balancing well loads. On a water flood where wells are closely spaced, rod lines are short, and long hours of pumping are the rule rather than the exception, this type of power may prove to be more economical than individual jacks and engineers recommend its consideration. All motor installations are belted, usually using a countershaft. In many cases where powers had been driven by gas or oil engine the old engine shaft is used as a countershaft. Usually when this is done one of the engine flywheels is replaced with a large pulley and the motor belted to this with a V-flat drive.

Where an operator anticipates expanding his operations he will install a motor large enough to care for future needs, knowing that power costs will be no greater so long as the oversize motor is operated at half load. (At less than half load efficiency drops off, so loads of less than half rating are not recommended.) This flexibility is made possible because an electric motor operating between half load and full load has a practically flat efficiency curve; that is, within this range the electrical output is practically proportional to the load.

Higher-speed motors are cheaper than slow-speed motors and since the high speed last quite as long and incur no more repairs than the slow speed, the former are widely used at Nowata.

To transfer motor load in horsepower to kilowatts a rough rule is to multiply the motor load in horsepower by 9/10. For instance, a 15-horsepower motor with a ten-horsepower load will take about 9/10 of ten or nine kilowatts for its operation, and will use electricity at the rate of nine kwh per hour. This is a rough rule—motors are rated in horsepower output, and one horsepower is 746 watts, or .746 kilowatts. Motor input is the output divided by the efficiency, which in motors between five and 100 horsepower ranges between 80 and 90 percent. Exact efficiencies guaranteed by manufacturers should be used when accuracy in figures is necessary.

THE OIL MAN'S CALENDAR

OCT. 6–8	American Gas Association, Annual Meeting, Cleveland, Auditorium Hotel.
6–8	ASME Petroleum Mechanical Engineering Conference, Houston.
8–10	AIME, Petroleum Division, Fall Meeting, Tulsa, Mayo Hotel.
10	California Natural Gasoline Association, Fall Meeting, Los Angeles, Ambassador Hotel.
13–15	American Association of Oil Well Drilling Contractors, Annual Meeting, Long Beach, Calif.
16–17	Texas Mid-Continent Oil & Gas Association, Annual Meeting, San Antonio, Gunter Hotel.
20–22	American Society of Mechanical Engineers, Fuel Division, Cincinnati.
23–24	American Institute of Mining and Metallurgical Engineers, Petroleum Division, Fall Meeting, Los Angeles, Elks Club.
24	Independent Natural Gas Association of America, Annual Meeting, Oklahoma City, Skirvin Hotel.
NOV. 5–6	American Association of Petroleum Geologists, Regional Meeting, San Antonio, Plaza Hotel.
6–7	American Association of Petroleum Geologists, Pacific Section, Annual Meeting, Pasadena, Calif., Huntington Hotel.
10–13	American Petroleum Institute Annual Meeting, Chicago, Stevens Hotel.
21–22	The Petroleum Electric Power Association, Annual Meeting, Corpus Christi, Tex., Robert Driscoll Hotel.
DEC. 1–5	ASME Annual Meeting, Chalfonte and Haddon Hall, Atlantic City, N.J.
1948 JAN. 14–15	American Association of Petroleum Geologists, Regional Meeting, St. Louis, Jefferson Hotel.
MAR. 24–26	Natural Gasoline Association of America, Annual Meeting, Ft. Worth, Texas Hotel.
24–26	Southern Gas Association, Galveston, Texas.
APRIL 14–16	American Petroleum Institute, Southwestern District Meeting, San Antonio, Plaza Hotel.
21–23	National Petroleum Association, Hotel Cleveland, Cleveland.
26–29	American Association of Petroleum Geologists, Society of Economic Paleontologists & Mineralogists, Society of Exploration Geophysicists, Annual Meeting, Denver, Shirley-Savoy Hotel.
MAY 4–5	American Gas Association, Natural Gas Department, Annual Spring Meeting, Houston, Rice Hotel.
6–7	American Petroleum Institute, Pacific Coast District Meeting, Los Angeles, Biltmore Hotel.
15–22	International Petroleum Exposition, Tulsa.
JUNE 30 July 2	American Petroleum Institute, Eastern District Meeting, White Sulphur Springs, W. Va., Greenbrier Hotel.
OCT. 4–9	American Gas Association, Atlantic City.

Nomads Chapter monthly meetings: LOS ANGELES, second Wednesday, Jonathan Club. HOUSTON, second Monday, Ye Olde College Inn. NEW YORK, first Monday, Louis Sherry's. TULSA, third Wednesday, Hotel Tulsa.

Electrical Costs

Operators using electrical power at Nowata are quoted a two-part rate by the utility company supplying energy, with separate demand and energy charges. The energy charge is based on the quantity of electricity, or number of kilowatt hours used. The demand charge is based on the maximum rate of use of electricity, or the size of installation. This use is meter-measured and billed on the actual demand from month to month which will vary as the load connected, or load in the motors varies with changes in operating procedure. This two-part rate has been found necessary in order that rates may follow costs of service and be competitive with alternate forms of power which the user might install. For example: 10,000 kilowatt hours per month can be used by a 20-horsepower motor running 24 hours a day, seven days a week, or by a 200-horsepower motor running three hours a day, five days a week.

Varied Rates

In general, rates quoted by different utility companies vary considerably not only in their terminology, but also in the method of figuring bills. A true comparison between rates, or between cost of electric service and alternative competitive service can usually best be made by figuring average cost per kilowatt hour, using the same set of conditions for the alternatives in question.

Other operating cost items are subject to many variations and therefore difficult to give any generally applicable rules or figures. For instance, operating labor in many cases may be the same whether electric operation or diesel operation is used; in other instances an appreciable amount may be saved. Repairs and replacements vary greatly with the make, type, and speed of engine, as do original investment costs. Comparison may be made between direct engine drive and electric operation or between power generated in a private plant and purchased power.

In Nowata, electrical energy has proved popular and efficient. As applied to water-flooding, perhaps its outstanding characteristic has been its reliability as a power medium where every barrel counts and where shutdowns are not only costly but often cause irreparable injury and decline in production which at best is only marginal.

How to do it!

PRODUCTION HINTS

$10.00 is paid for each illustrated acceptable contribution. Mail to The Editor, WORLD OIL, P. O. Box 2608, Houston 1, Texas.

How To—Design Pumping Unit Foundation for Easy Abandonment

The massive concrete foundation usually poured at a producing well to support the individual pumping unit requires much labor to excavate the structure when it is necessary to abandon the lease and level the site. If the well is located on land which is to be turned back for agricultural purposes, the concrete must be removed to a point below any depth reached by the plow. Clearing such a foundation in this manner usually requires the use of dynamite in breaking up the concrete into pieces which must be hauled away.

To reduce this expense in the abandonment of a well, one company designed a method which makes it relatively easy to clear the site. An excavation with sufficient depth and area to accommodate the pumping unit is made at the location. Salvaged pipe of three inches diameter or over is used for the supporting legs and is cut long enough to extend from the floor of the excavation to about 20 inches above ground level. After setting the pipe with a template, concrete is poured in the excavation, and if desired, sucker rod material may be used to reinforce the structure.

Concrete is used to fill the hole to a point approximately two feet below the surface, and the remainder of the excavation filled over with soil. Only the pipe legs extend through the top soil and above the ground, and are used to support the pumping unit sub-base. Foundation bolts are secured in the open ends of the pipe by pouring cement into the pipe until it surrounds the bolts. Upon hardening, the cement holds the bolts in place with sufficient rigidity to form a substantial base for the pumping unit.

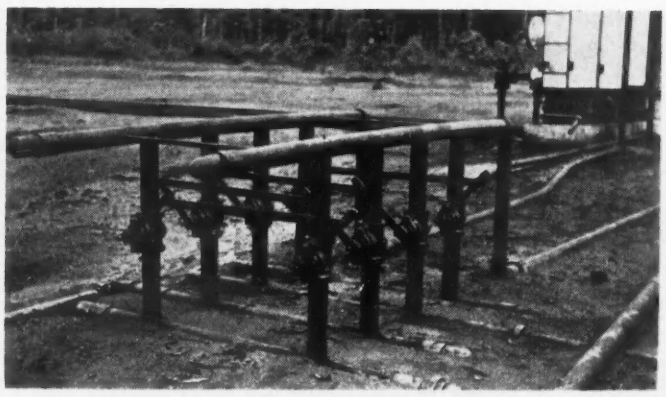
When the lease has been pumped dry and the well is to be abandoned, it is only necessary to shovel the top soil away from the supporting legs so that a welder may cut the pipe supports off just above the cement. When the top soil is leveled off, the area is ready for other purposes, leaving no evidence of any previous foundation.

How To—Automatically Switch Lease Flow Lines Into Test Separator

Special tanks and separators are usually provided on most leases to make it possible for the pumper to accurately test periodically the productivity of oil, gas and water of each well individually. The test tank and separator are, in many cases, a separate system tied in to the producing wells through a manifold containing the necessary valves, etc. A convenient method of switching the flow of fluid from the lease separator, into which several wells may be flowing simultaneously, into the test separator without disrupting the flow from the well is described and illustrated.

Production from four wells was manifolded through a 2½-inch flow line into the lease separator which discharged into the lease tanks for delivery to the pipe lines. A parallel manifold of exact design as the first was connected to the flow lines to divert production from any one well through the test separator. Plug type valves were used as shown and mounted on the vertical risers the same distance from the ground in both manifold systems. When the line connecting the manifold into the lease separator was open, the valve on the test manifold for that same flow line was closed, relative position of the valve plugs in each case being separated by 90 degrees. Although the valve handles were parallel as shown one line was open while the other was closed. A strap steel linkage between the two valve handles keeps this relation permanent.

When the pumper desires to make a test on any well flowing into the system, all he has to do is close the line into the lease separator, and in so doing, he automatically opens the line into the test separator. Such an arrangement makes it unnecessary to discontinue the flow to switch over to the test system.



If You've Heard It Whispered That American Manufacturing Co. of Texas Is Quitting the Supply Business,

GIVE US YOUR NEXT ORDER* AND SEE HOW FAST YOU GET DELIVERY!

*** For Pumping Units, Rod Line Equipment, Jacks, and Almost Any Item of Surface Equipment**

★

During the war we were so busy producing *millions of shells for the Army and Navy* that some folks were saying, "maybe American will never go back into full production on oil field items."

This idea is WRONG, and we want to set the record straight. American has never *quit* making Pumping Units. We made them all through the war years, and expect to be making them for many years yet. Since the war the American Pumping Unit line has been completely redesigned and improved. Production is being stepped up, and today you can get what you want . . . and get it *fast*, when you order from American. Ask our customers or try us and see for yourself.

Swaged Nipples
Pumping Jacks · Casing Nipples
Tubing Nipples · Braden Heads

American Manufacturing Co. of Texas

Unit Pumpers · Crown Blocks
Turnbuckles · Bull Plugs
Swings

Since 1924

FORT WORTH 1, TEXAS
Phone 6-5401

KILGORE
Phone 138

ODESSA
Phone 666

PENBERTHY
SUMP PUMPS

Used wherever seepage water accumulates, the Penberthy Automatic Electric Sump Pump and the Penberthy Automatic Drainer (water or steam operated) have demonstrated their superiority in this service. Simple and rugged design—copper and bronze construction throughout.

PENBERTHY INJECTOR CO.
DETROIT, MICH. Canadian Plant WINDSOR, ONTARIO

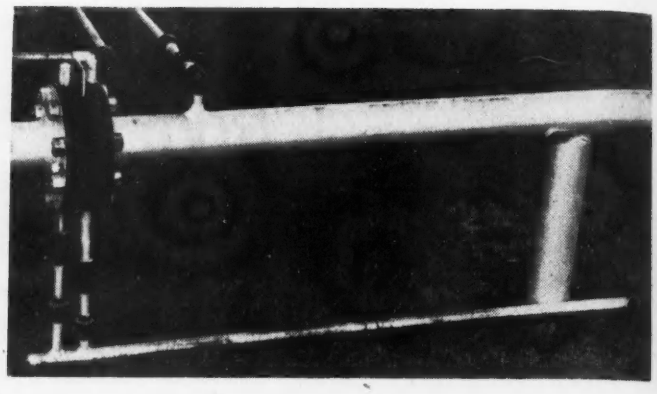
PENBERTHY
EJECTORS

Use the power of steam, air or water under pressure to lift liquids. Being simple jet pumps they have no moving parts and require no lubrication. A variety of models to meet different conditions. Also used as water heaters.

PENBERTHY INJECTOR CO.
DETROIT, MICH. Canadian Plant WINDSOR, ONTARIO

How To—

Remove Hydrates which Accumulate at Orifice Flanges



Hydrates form and collect on both sides of the orifice plate in a horizontal meter run. If this fluid is not drawn off it will slug through the orifice or cause the stream of gas to take a form which is not that on which the equation for computing flow is based. The liquid also tends to cause corrosion of the plate. This in turn varies the size of the orifice and gives incorrect readings.

A drain is tapped in to each of the orifice flanges at the lowest point, and half-inch pipe used to provide drains. The drains each have a plug cock and union, and are welded into a horizontal lead which has the end bent to direct the flow away from the run. The pipe is made long enough so that the blow will force the drain back against a meter-run post. This relieves the two valves of any strain.

How To—

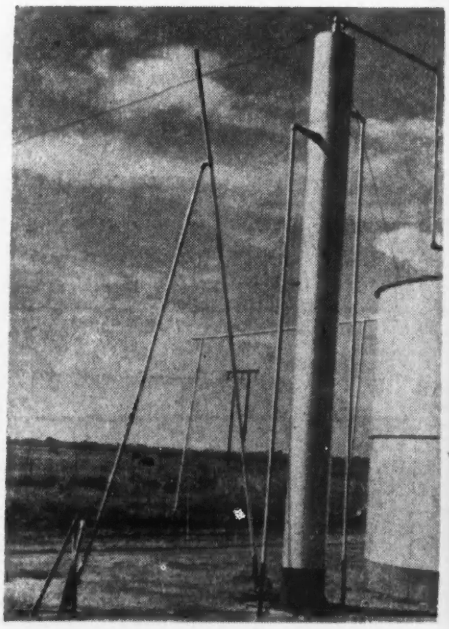
Separate Small Amounts of Gas and Water From Crude

In fields where wells produce small volumes of gas with the oil and where the salt water drops out easily, a shop-made separator will, in some cases, produce satisfactory results. Illustrated is one such separator fabricated in the welder's shop by a producing company. The unit was made up from four six-foot sections of 20-inch pipe, capped at both bottom and top. A two-foot square plate formed the bottom cap, which, when reinforced with 45-degree braces, provided a base for the separator.

Four connections are made into the unit. A three-inch collar was welded about six inches from the base plate to provide a salt water drain for the unit. Another three-inch collar was welded to the top, through which the gas passed into the tank battery vent lines. Approximately three feet from the top of the separator was welded the oil outlet which connected to the lease gathering tanks. The fourth three-inch collar was welded one foot below the oil outlet, and on the opposite side of the unit, to form the inlet connection. All lines leading into the separator were two-inch and had to be swedged down to the three-inch collars.

An automatic salt-water bleeder with an adjustable drain level was connected to the bottom tap of the separator. By lowering or raising the bleeder as conditions required, the water was automatically drawn off.

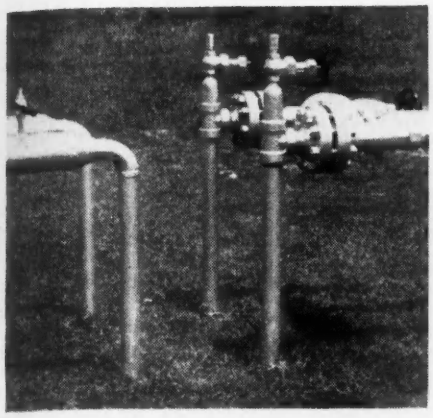
The complete unit was set on a concrete base and guyed with three cables. Very little attention is required of the lease pumper to maintain constant operation of the separator, and because the pressures are not excessive, the unit "fills the bill" in this particular field.



PRODUCTION HINTS

How To—

Anchor Flow Lines



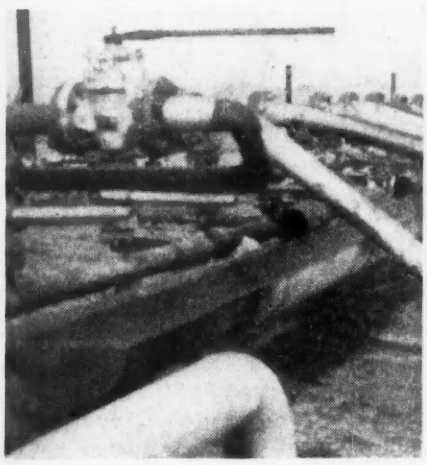
Dual flow lines from tubing and casing of a gas condensate well are led from the meter house and then swaged to two-inch size before attaching the flow beans. One company does not make a straight connection between meter run and regulating unit. Instead, the lines are fitted with sweep ells to take the piping below ground. A wide, flat U-bend then brings the lines up to tees at the base of the flow regulating valves. These, in turn, are tied on their discharge sides to a tee on the end of the main flow line.

The "U" put into the line acts to eliminate vibration set up by well flow or in the needle valve units. It also absorbs all change in length of any line and protects meter and bean fittings from expansion stresses. The earth tamped around the vertical pipes prevents shift enough to displace any line.

The open space through the flow lines also serves as a walkway around the meter house and saves climbing over the lines and marring of the aluminum paint finish.

How To—

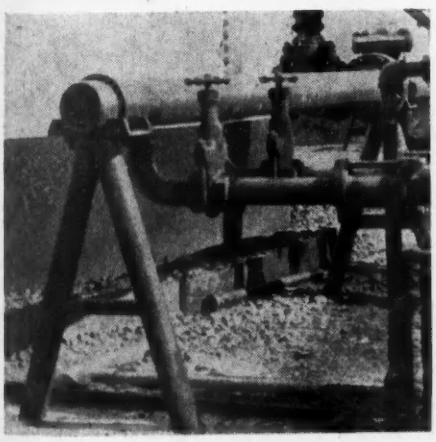
Dispose of Waste Oil



Grouping of lead lines from individual wells carries the manifold to distribution leads to a central separation and treating unit for the convenience of the lease owner and the men who test the oil as it is produced. Sampling is simplified since all lines are at a common point, and cocks attached to the various lines are all on a direct line above a waste trough which catches incidental spills and conveys the waste to a common gathering line leading to a sump from which all waste is pumped to the oil treating plant. Not only is the oil saved, but the premises are maintained in appearance, as well as removing a fire hazard.

How To—

Support Suction Manifold

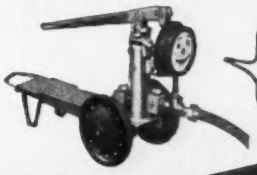


To eliminate vibration and maintain correct alignment of pump piping on an oil treating unit, the design engineers included a substantial support consisting of "A" frames set solidly in concrete. The "A" frames are made of common pipe, fabricated by welders for utility and appearance of the setting.

A saddle at the top to retain the line is made by shaping a piece of channel iron, having the corners slightly rounded to remove sharp edges, and drilled to receive "U" bolts which anchor the pipe to the supporting member. The lower end of the "A" frame legs are set in a form subsequently filled with concrete to the level of the area at the tanks. Suction for the pumps is connected to the bottom of the header to eliminate air lock, and expansion and contraction compensated for by the use of bolted sleeves.

They call me "HANDY ANDY"

I can test pipe and fittings, remove cores, and develop pressures up to 6,000 psi for any and all types of testing. I weigh approximately 68 lbs. on a solid base, but if you don't want to lug me around, then order me with wheels.



BAKER hydraulic HAND PUMP

ASK THE BAKER MAN

INCREASE PRODUCTION
Clean Out With
MILLER

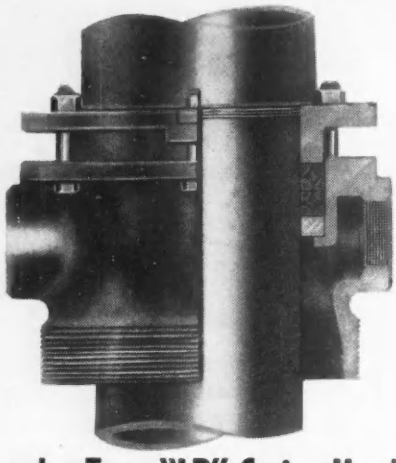
SAND PUMPS

O.D. SIZES
2½"
3 "
3½"
4¼"
5 "
5½"
7 "

LENGTHS
20'
25'
30'

REGULAR BAILERS

Miller Sand Pump Co.
General Office Box 4516
OKLAHOMA CITY 9, OKLA.
EXPORT OFFICE
30 Rockefeller Plaza
NEW YORK CITY 20, N. Y.
See Composite Catalog Page 2426



Hercules Type "LP" Casing Head

This casing head is a light Louisiana Pattern Stuffing Box Type Head. It is made of high quality electric cast steel throughout, having a test pressure of 2,000 lbs., p.s.i. This head is short, light in weight, yet strong enough to safely support the weight of the longest string of casing for which it is designed. The "LP" head is ordinarily made with male casing thread connection, however it may also be furnished with a female casing thread in several sizes. It is an economically priced head.

• SPECIFICATIONS

Type: "LP" (Louisiana Pattern)
Material: Cast Steel
Design: Stuffing Box Type Packing Arrangement and Male Thread Casing Connection.
Test Pressure: 2,000 lbs. per square inch.
Working Pressure: 1,000 lbs. per square inch
Support Ring: Forged Steel, Split.
Packing: Sq. Braided Flax or Jute Packing.
Packing Glands: Cast Steel in halves with overlapping joints.
Side Outlets: Two, 3" Line Pipe; 2" Optional. Also available with one threaded for 2", 2½" or 3" line pipe.

HERCULES TOOL COMPANY
TULSA 1, OKLAHOMA, BOX 286
Export Office: 30 Rockefeller Plaza, New York, U.S.A.
Cable Address: HERTOCO.

Increase RESERVES AND PROFITS BY *Secondary Recovery*

EXPERIENCED PRACTICAL CONSULTING REPRESSURING AND WATER FLOODING PRODUCTION ENGINEERING SERVICE

- Preliminary Surveys
- Gas Measurements
- Bottom Hole Pressure
- Compressor Plants
- Installation
- Water Treating Plants
- Core Analysis
- Estimate of Results
- Valuations
- Supervision

PETROLEUM ENGINEERS
CABLE & STINE
WICHITA FALLS, TEXAS

PRODUCTION HINTS

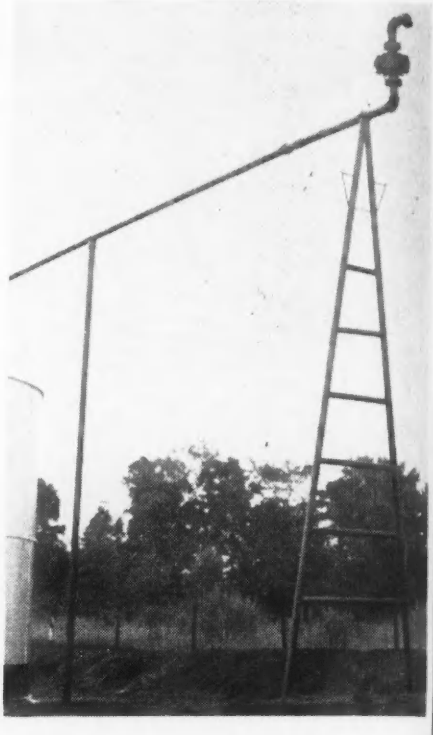
How To—

Incorporate Ladder in Stock Tank Vent Support

To prevent excessive evaporation of high-volatile crude, it is advisable to maintain slight back pressure on the flow tank. It is also a fire preventive measure to have a flame arresor on the vent line to cut off danger of flashback through the line when a tank is being emptied.

The valve and flame arrestor on the vent line tends to clog after long usage, and must be cleaned to insure proper action. When servicing is needed, some means of reaching the elevated device must be provided. One company utilizes the A-frame support for this purpose by welding cross members at 18-inch intervals to serve as rounds of a ladder. At the top, where the space is too cramped for good footing between the uprights, steps are welded outside the risers, with short spurs at the outside edge to prevent slipping.

The top steps are at the correct height to enable the operator to straddle the pipe while working on the valve and arrestor, and thus to have both hands free for the job.

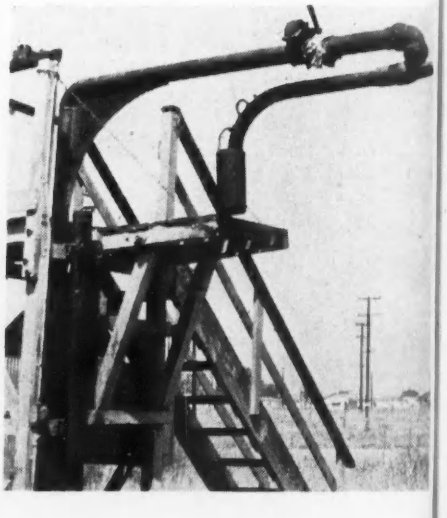


How To—

Construct Tank Loading Rack on Remote Leases

To provide a maximum of efficiency and convenience when loading out truck tanks which transport oil from wells not otherwise connected to pipe lines, one company erects a compact and easily operated loading rack. The lines carrying the oil pass into a vertical riser of standard height to accommodate tank trucks, using weldells to connect the horizontal swing. In the vertical riser near the floor of the platform is a ball bearing swivel joint which permits the operator to make necessary adjustments by swinging the loading pipe in any direction necessary. The loading nozzle is attached to a second joint of pipe connected to the horizontal swing near the center of the second pipe tc balance the weight. One end is closed while the other is bent at an angle of approximately 90 degrees to direct the oil downward through the dome of the tank.

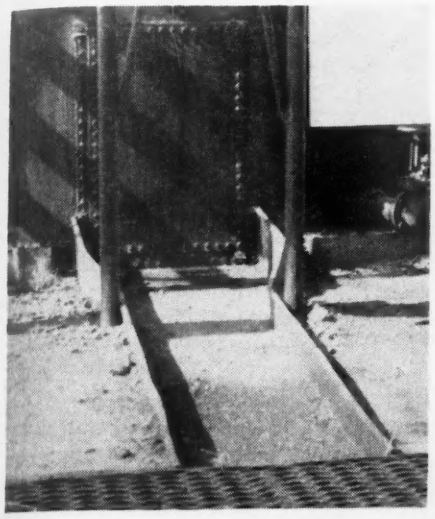
A quick open and shut valve in the horizontal line provides accurate control of the oil flowing towards the tank. A hook on the loading spout provides means of hanging a small drip pot to catch seeping oil to prevent loss and to preserve appearances of the area. To start and stop the loading pump, a remote control switch is placed on the handrail of the loading platform so that no time is lost for loading or cutting off the stream of oil from the pumps.



PRODUCTION HINTS

How To—

Build Clean-Out Flume



Instead of removing the manhole at the base of a tank and allowing the BS&W to flow unrestricted "all over the place." one company builds a clean-out flume which is attached to the tanks at the manhole opening. The flume reaches from the base of the tank, with a retaining lip inserted under the bottom deck so that fluids removed from the manhole will not flow into the ventilated foundation, to a concrete ditch covered with steel grating. The wings of the flume are high enough that bs&w gushing from the tank when the cover is removed is prevented from splashing, and the sides have enough height so that the sludge is guided adequately into the drain, which in turn leads to a sump from which water and oil are pumped to other equipment for separation and the salvage of oil.

How To—

Inspect Tank Drains

Fire hazards around a tank battery are reduced if all drains are enclosed. When draining off the water bottoms from a tank, however, it is necessary to watch the flow and to sample it from time to time to avoid waste of good oil.

A tank drain line which allows inspection uses the standard two-inch drain line with a right-angle turn welded to a six-inch pipe leading to the sump or burning pit. The six-inch line has an 18-inch "window" cut in it near the entry of the drain elbow. The piece cut out to

...a new Le Roi pumping-engine development that reduces lifting costs per barrel by giving condensation and sludging the run-around

We don't have to tell you what condensation and subsequent sludging do to engines. But we do want to tell you what we've done to stop these conditions:

Our engineers have developed what we call "heat balance." It greatly reduces condensation and successfully eliminates sludging, by providing proper temperature control in both the cooling and lubricating systems — regardless of ambient temperatures.

Here are a few important features that make "heat balance" possible: Thermostatically controlled radiator shutters. Insulated oil pan. Water-cooled exhaust manifold. Closed breathing system.

This new Le Roi pumping-engine development is of special value in sour-gas areas or in regions with extreme temperature range. Because of sludge elimination: Parts last longer. You have fewer repairs; less down-time. Efficiency is higher. Lifting costs per barrel are lower.

Additional well-known Le Roi features: Extra-heavy flywheels with generous WR^2 values. Extra-large heavy-duty clutches. Unique Le Roi valve-in-head design. Removable wet cylinder sleeves. Precision bearings. Protective safety devices. See your Le Roi distributor for all the details. Bring your files up-to-date—write us for latest literature.

LE ROI COMPANY, MILWAUKEE 14, WISCONSIN
NEW YORK • WASHINGTON • CLEVELAND • BIRMINGHAM • TULSA • BUTTE • SAN FRANCISCO

LE ROI MILWAUKEE

Oklahoma
Le Roi Company Branch — Tulsa
Carson Machine & Supply Co. — Oklahoma City

East & South Texas, Gulf Coast
Southern Engine and Pump Company — Houston, Kilgore, Edinburg, Dallas, San Antonio, Texas, and Lafayette, Louisiana.

North & West Texas, New Mexico
General Machine & Supply Co. — Wichita Falls, Odessa, Lubbock, Texas.

Kansas
Carson Machine and Supply Co.—Great Bend

Illinois — Western Kentucky
Western Machinery Company — Centralia, Illinois and St. Louis, Missouri.

Michigan
Hafer Engine Service — Reed City

Rocky Mountain Area
Gehring Equipment Company — Casper, Wyoming.

Northern Louisiana & Mississippi
Ingersoll Corporation — Shreveport, Louisiana, and Jackson, Mississippi.

West Coast
Le Roi-Rix Machinery Co. — Los Angeles, Calif.

Appalachian Area
Lloyd, Smith Company — Bradford, Penn.
P. C. McKenzie Co., Pittsburgh

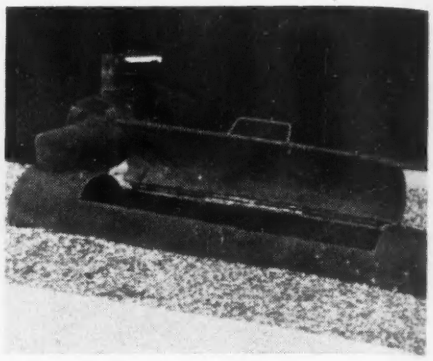
Canada
Drilling Supplies, Ltd. — Calgary, Alberta

Complete Sales and Service Facilities

P-91

"VIC" VICTAULIC SAYS...
"On Piping Installations . . . We'll Save You Money and Man-Hours!"
"Before you install any piping system, remember this: to save money and man-hours...use Victaulic Couplings!
"Because the easy 'two-bolt way' of locking Victaulic Couplings gives you speed and ease of assembly—or salvage. There's no guesswork, no marking of pipe, no special skill or training needed—just 'button up' two half-housings with a speed socket wrench and you've got a flexible pipeline with a union at every joint!
"In Victaulic-coupled pipelines contraction-expansion is taken care of automatically...and any pipe length, valve or fitting can be removed for repairs without backing off adjoining sections.
"So—not only are Victaulic Couplings your answer for low-cost installations. They're also your answer for low-cost maintenance!
"And for full economy in your pipeline, be sure to use Victaulic Full-Flow Elbows, Tees and other Fittings. They increase pipeline output...at lower pumping costs!"
Write for new Victaulic Catalog and Engineering Manual
VICTAULIC COMPANY OF AMERICA
30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.
Victaulic, Inc., 727 W. 7th St., Los Angeles 14, Calif.
Victaulic Company of Canada, Ltd., 200 Bay St., Toronto 1
For export outside U. S. and Canada: PIPECO Couplings and Fittings: Pipe Couplings, Inc., 30 Rockefeller Plaza, New York 20, N. Y.
Have you considered Victaulic for your piping requirements?
Sizes—¾" through 60"
SELF-ALIGNING PIPE COUPLINGS
VICTAULIC
EFFICIENT FULL-FLOW FITTINGS
Copyright 1947, by Victaulic Co. of America

PRODUCTION HINTS



form the window is welded to hinges which, in turn, are welded to the drain line. The cover may be swung back to check flow or take samples. While the line is not in use the cover is closed. This keeps out leaves, dirt and small animals. With the cover in place, the line needs cleaning only if paraffin accumulates. A handle, formed from welding rod, makes it easy to open or close the window cover.

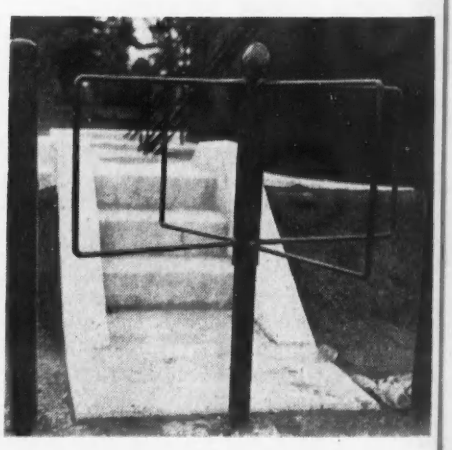
How To—

Reduce Fire Hazard

Wooden steps across the firewall at a tank battery are a fire hazard and have been known to provide a bridge over which grass or forest fires have reached and damaged tanks inside the walls. The same is true of long walks which span from outside the fire wall to a point on the tank steps.

One company uses precast concrete steps for the firewall crossing. The entire unit, consisting of landing inside and outside the wall, twin flights of three steps each, and side walls to hold back the earthen walls, is made upside down in forms at the workshop, and carried on a truck to the lease. A trench is cut into which the base fits, and the earth tamped into place on both sides.

The steps are left rough enough to be slip-proof, but can be cleaned with a little gasoline if crude is spilled on them.



MEETING GAS PEAK DELIVERY IN THE APPALACHIAN AREA

MEETING GAS peak loads is a problem everywhere in the country. In the Appalachian area gas companies have helped solve it by underground storage of gas. At the present time more than 50 gas storage pools are in that section. This article discusses selection of suitable areas for storing gas and factors that must be considered to assure success.

By H. J. WAGNER

DURING the war, because of the restrictions governing the extension of gas service and through the patriotic efforts of producers and distributors of natural gas, essential industry in the Appalachian area, with minor exceptions, received sufficient natural gas for continuous operation. Early in the war, however, it became apparent that the growing demand for natural gas in this area could not be supplied from local fields. This situation resulted in the construction of the Tennessee Gas Transmission Company line, completed late in 1944, and which then began delivery of more than 200 million cubic feet of gas daily into the Appalachian area. Prior to the construction of this line some natural gas had been delivered into the area by the Panhandle-Eastern Pipe Line Company.

With the arrival of VJ Day, gas company executives and employes as well as regulatory authorities and others concerned with this problem breathed a sigh of relief such as we used to hear when the family car reached the top of a hill during the motoring days of the early 1920's. The supply during the ensuing winter (1945-46) was generally ample to meet all demands and the gas companies entered 1946 with a sales program designed to increase domestic and commercial sales to provide a market for gas that was expected to be available because of the anticipated decrease in industrial sales. It was not long, however, until it was evident that the decline in industrial sales would not be a reality. By the summer of 1946 the demand for gas-fired furnaces, conversion burners, floor furnaces and similar space heating equipment had reached such proportions that the utility companies became concerned about meeting the winter peak.

Conversion of the Big Inch and Little Big Inch lines to the transportation of natural gas and the delivery of about 125 million cubic feet of gas through these two lines daily was of material help in meeting last winter's peaks. Notwithstanding the increased deliveries from the Tennessee line, the gas received through the "Inch" lines and the production and removal from storage of all locally available gas, a daily shortage of over 500 million cubic feet was experienced early in February, 1947. Available figures indicate that the peak demand during the winter of 1946-47 on the natural gas system of the Appalachian area was 20 to 30 percent higher than the peak demand of the previous winter.

H. J. WAGNER has been the West Virginia representative on the Interstate Oil Compact Commission for the past two years. His activities on that body have been marked by his strong support of all measures pertaining to oil and gas conservation. He has been particularly active as chief of the gas division of the Public Service Commission of West Virginia in promoting measures especially designed to effect the conservation of the state's gas resources.

Meeting the peak is not a new problem in the Appalachian area. Due to the very cold weather that prevails over a large part of this area during the winter months and the relatively high density gas heating load, this problem has been present for many years and for the past ten years underground storage has played a large part in helping to solve it.

Underground Storage

The underground storage of natural gas, i.e., injecting gas into depleted or partially depleted natural gas and/or oil sands, according to available records, was first tried in Canada more than 30 years ago. But it was not until about 1934 that the underground storage of natural gas, as practiced today, had its read beginning.

At the present time there are more than 50 gas storage pools in operation in the Appalachian area. These pools contained over 100 billion cubic feet of gas on November 1, 1946, and delivered approximately 40 billion cubic feet during the five-month period, November 1, 1946, and April 1, 1947.

Most of the large pools have never been filled to their maximum capacity, so the amount of gas that could be withdrawn from these pools daily, if the pools were full, is not known. However, with the gas in storage on November 1, last year, deliverability was estimated to be more than 1 billion cubic feet per day.

In the early days of gas storage the operators were primarily interested in small pools having a high daily delivery rate which could be depended upon for

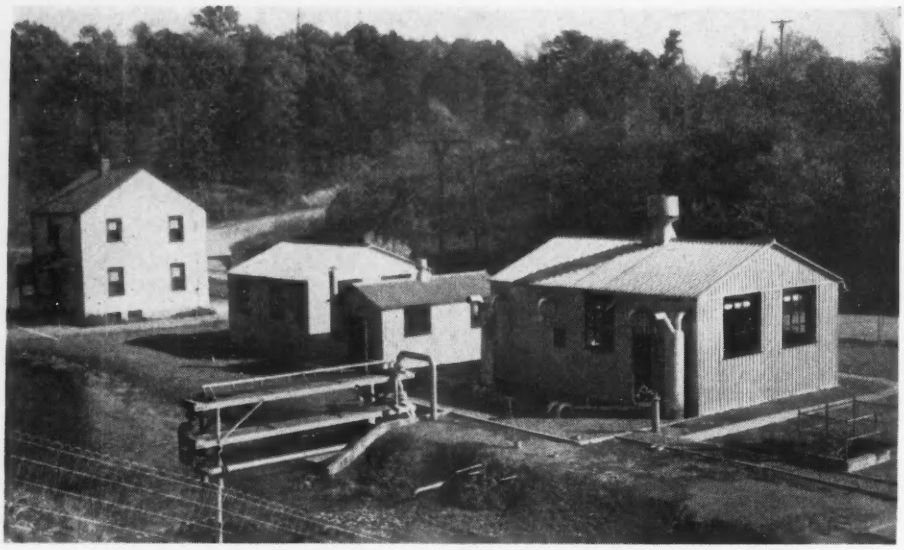


Figure 1. Typical compressor station for small pool in Appalachian area. This station serves four wells, acting to build up input pressures for storage, and to boost withdrawal pressures to pipe line requirements on delivery portion of cycle.

a supply of gas to meet peak loads on exceptionally cold days. Today such peak pools are equally important, but in addition the companies need and have developed larger pools from which part of the winter base load gas can be supplied. These larger pools also provide storage for any gas delivered during the summer months that is not needed to meet current demands, thus permitting the operation of the long transmission lines at a high load factor.

The selection of an area suitable for storing gas requires a very careful study of many factors. The size of the storage area selected depends upon whether it is to be used as a base load or peak load pool. A small area from which the original production was obtained through a few wells in a very short period of time makes an ideal peak pool provided it meets the other requirements. The requirements for a base load pool are practically the same as for the peak load pool except that it will cover a much larger area, provide storage for a greater volume of gas, and be capable of delivering large quantities of gas over a period of five or six months. Pools being operated in the Appalachian area range in size from 50 to 25,000 acres.

Other factors that must be investigated are drillers' logs of all wells drilled into or through the sand in which the gas is to be stored, casing and tubing records of these wells, original rock pressure and open flow of all wells that produced from the sand selected, rock pressure decline and deliverability data, porosity and permeability of the sand, total Mcf of gas originally produced, the presence or absence of water in the sand, the areal extent of the pool, and the extent to which this factor was determined by wells previously drilled. If any wells in the area were abandoned, a copy of the plugging record should be obtained. An improperly plugged well may allow water to get into or permit the escape of gas from the sand.

Testing the Sand

Before proceeding further with the project the sand should be tested. This can be done by injecting a sufficient volume of gas into the sand to increase the rock pressure and noting: (1) The volume of gas necessary to obtain a given increase in rock pressure; (2) The pressure and time required to inject a given volume of gas; (3) The time required for the pressure to equalize at the various wells; and (4) the shutin pressure which will indicate whether gas is or is not escaping from the pool.

Gas for this purpose may be obtained from a high-pressure pipe line or by installing a portable compressor. If the above conditions appear to be satisfactory, all old wells that are to be used either as input or output wells must be reconditioned or at least tested to make sure that they are clean and that the casing is in good condition and will withstand the highest pressure at which gas will be injected. Since it is desirable to use large tubing in storage wells, it generally will be necessary to replace the old tubing with larger pipe and all fittings and pipe in the wells and lines must be suitable for the maximum pressure to be used. A few years ago it was the general practice not to exceed the original rock pressure of the sand. However, today some of the pools in the Appalachian area are operated at pressure higher than the original rock pressure.

The question of the maximum pressure is particularly important, as this pressure will govern the horsepower of the engines and the size and capacity of the pump station auxiliary equipment. Most of the gas companies using storage pools in this area find it necessary to pump gas into the pools at the higher pressures and either to leave a large gas cushion in the pool or to pump gas out of the pools at low pressures.

Pumping gas out of the pool creates an additional problem because compressors designed for high pressure service (pumping gas in) are very inefficient and the volume that can be pumped is small when handling low-pressure gas (pumping gas out). If the range of pressures between maximum and minimum is such that the compression ratio can be held within reasonable limits, the efficiency of the station can

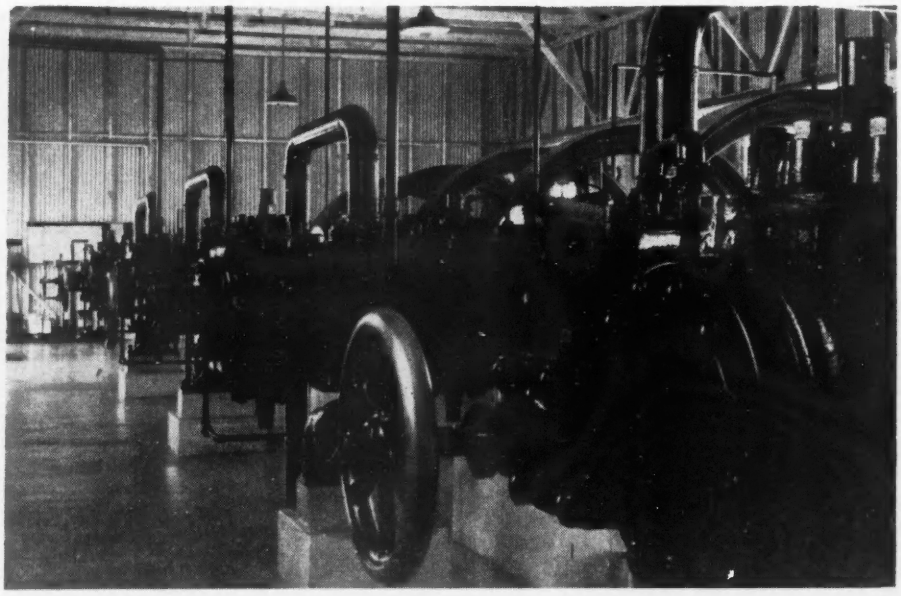


Figure 2. Compressors in typical station. At the extreme right is regulation device for balancing load on high and low pressure sides of compressor by varying volume of low pressure side of unit. In this station 485 horsepower provides power for storage or delivery for gas at the rate of 41 Mcf per 24-hour day.

be improved by the use of clearance pockets, cylinder reliners, or by changing compressor cylinders.

In stalling cylinder reliners or changing compressor cylinders is not very satisfactory because under any given set of conditions the operation is restricted to the one type of service (pumping in or pumping out) until the compressor cylinders have been changed. Where the pressures vary over a wide range, multiple stage compressors are more satisfactory. Input gas must always be clean. It also should be dry unless the sand contains salt water. One company, storing gas in a sand containing salt water, found it necessary to raise the humidity of the input gas because the dry gas absorbed water from the brine and caused the salt to crystalize, closing the sand pores near the producing sand face. Most of the pools in use, however, are practically dry, and by injecting dry gas any small amounts of water in the sand are removed gradually, sometimes increasing the deliverability rate. In cases where pressures are quite high the gas must be dry to prevent freezeups due to the formation of hydrates. Some companies operating high pressure pools have found it necessary to install dehydration plants.

Each pool is an individual problem; therefore, it is impossible to give any figures on the size of compressors or other equipment that would be required for a particular pool. Figure 1 shows a typical installation in the Appalachian area. Figure 2 is a view of the interior of the compressor building at the same station. The installed compressor capacity is 485 horsepower. There are four wells in the pool, all of which are used as input and output wells. The pool covers 747 acres, has a storage capacity when full of more than 3 billion cubic feet at 650 pounds per square inch, and will deliver when full at the rate of 41 million cubic feet in 24 hours. On November 1, 1946, this pool contained approximately 3 billion cubic feet of natural gas and it delivered 1.9 billion cubic feet of this gas during the five months, November 1, 1946, to April 1, 1947.

Figure 3 shows input and output curves for this pool and Figure 4 is a deliverability curve.

There are other storage possibilities that have been suggested or tried that are worthy of mention. One is the storage of gas in a sand that originally did not contain oil or gas. Another is the storage of gas in a sand that originally contained a small amount of natural gas with a very active water drive. Both of these problems are still being studied and present indications are that both are worthy of further investigation.

Everyone interested in the storage of gas has read the articles recently published in the trade journals describing the storage of gas in buried sections of pipe, a project of the Public Service Company of Northern Illinois. The authors of one of these articles stated they anticipate that this type of storage will be quite papular because of its obvious advantage and flexibility.

The storage of gas in an abandoned mine (coal, limestone, etc.) has been suggested but not tried so far as the author knows. Line packing to meet peaks of short duration has been successfully used for many years. The liquefaction and storage of natural gas in the liquid state and also as a hydrate involve principles entirely different from the underground storage method but both methods may some day become important tools for meeting the peak. Many articles on both of these methods can be found in the literature of the past few years.

Liquefied Petroleum Gas-Air Plants

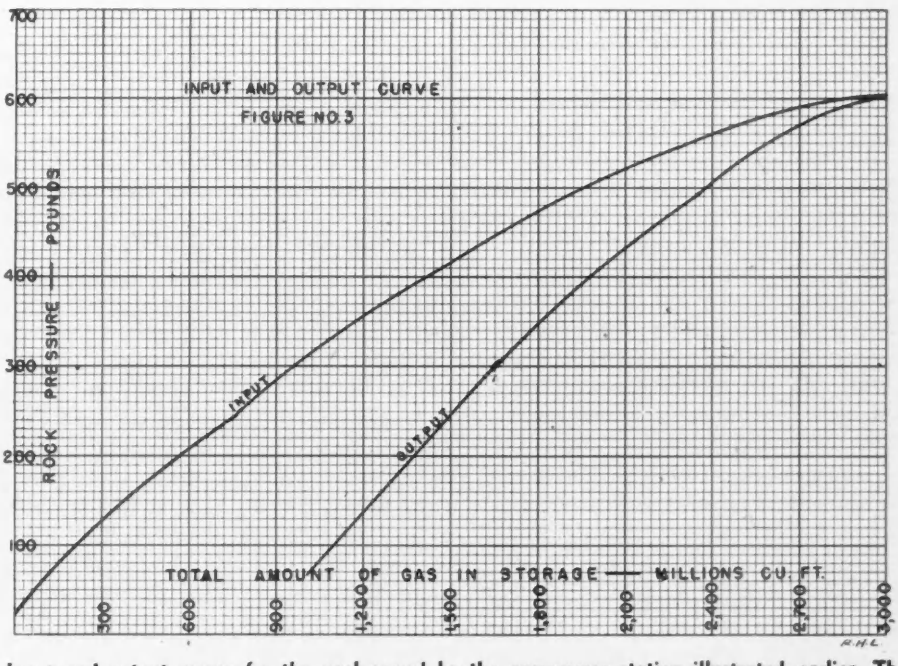
In 1945, one of the large gas utility systems operating in the Appalachian area began the construction of nine liquefied petroleum gas-air plants with a total daily delivery capacity of 105,000 Mcf of natural gas equivalent. Similar plants previously had proven their value as standby for industrial customers of the natural gas companies, as a source of gas supply for the smaller cities and towns that did not have natural gas available, and as an aid to meeting the peak of the manufactured gas plants in some of the larger cities in this area.

The liquefied petroleum gases used in these plants are commercial propane or butane obtained from natural gas or from oil refineries. Both of these gases liquefy under moderate pressure at atmospheric temperature* and therefore for convenience are shipped and stored under pressure as liquids.

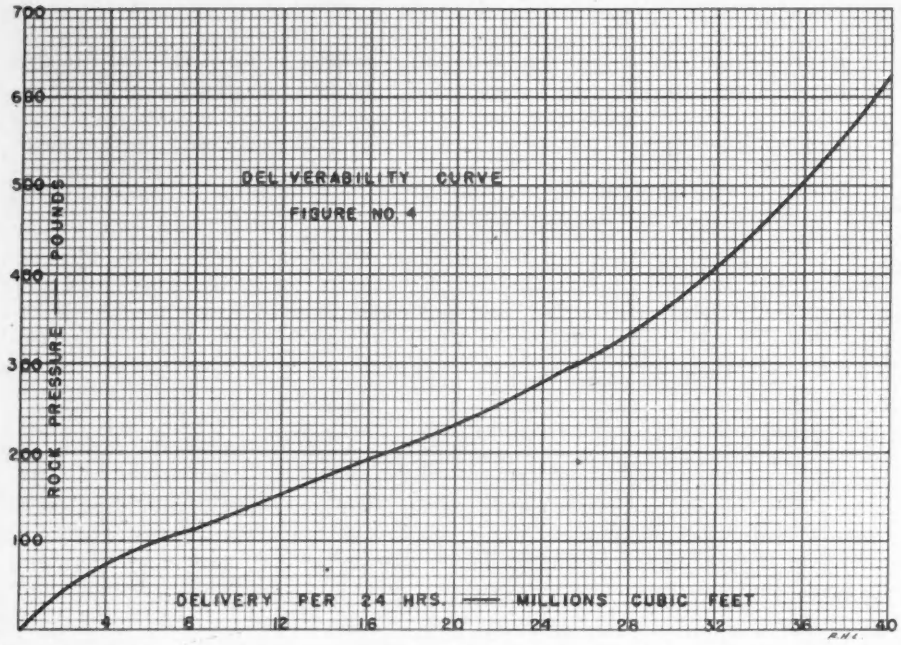
Natural gas as it comes from the wells is a very complex mixture of hydrocarbons, often containing varying quantities of other constituents, the principal ones being carbon dioxide, nitrogen, various sulfur compounds and helium. The specific gravity of such a gas may vary from approximately .60 to more than 1.0, depending on the composition of the gas. The relative amounts of the various hydrocarbons and other constituents present in the gas also will determine its heating value. However, the natural gas distributed for general use in the Appalachian area usually will be found to have a specific gravity somewhere between .60 and .70 with a heating value of 1000 to 1200 British thermal units per cubic foot. All three of the above factors, i.e., the chemical composition, specific gravity and the heating value of a gas, are extremely important factors when we attempt to mix natural gas with liquefied petroleum gas or with manufactured gas.

This subject is much too involved to discuss in this paper. Anyone interested should secure a copy of American Gas Association Research Bulletin Number 36 "Interchangeability of Other Fuel Gases with Natural Gas." A study of this bulletin will show the complexity of the problem even as a pure research investigation conducted in the laboratory. When we add to this the factors of difference in burner setting and design, the variation in chemical composition of

* Boiling point of butane at atmospheric pressure, 30° F. Boiling point of propane at atmospehric pressure, 44° F.



Input and output curves for the pool served by the compressor station illustrated earlier. The maximum rock pressure shown is approximately that of the overburden, and represents a theoretical peak condition.



The deliverability curve shows the availability of stored gas in millions of cubic feet when plotted against rock pressure within the pool. As the quantity available increases, the spread between delivery pressure and pipe line requirement decreases.

the natural gas and the fact that commercial propane or butane is not a pure product but quite often contains various percents of both of these and other hydrocarbons such as iso-butane, propylene, etc., it is not surprising that a theoretical calculation to determine how the many different types of burners that are connected to any gas utility's mains, will operate with a mixed gas send out is extremely difficult of solution. It is not the intention to infer that the formulae are not correct for they will give generally satisfactory results if all factors are known and properly evaluated. It is suggested, however, that after the calculated interchangeability has been determined an actual test be made using most of the different types of burners, particularly if the send out gas is to contain a high percentage of the liquefied petroleum gases. This is necessary to eliminate the possibility of unsatisfactory burner operation and the danger resulting from flash back, yellow tip flames or lifting of the flame from the burner ports. A sendout gas containing a mixture of natural gas and a liquefied petroleum gas must always have a higher heating value than the natural gas if burners are to operate safely without adjustment. Most of the natural gas companies operating in the Appalachian area sell gas on a Mcf basis and therefore receive no compensation for the increased heating value of the gas if the gas is measured by displacement meters. On orifice meter measurements the higher specific gravity of the mixed gas causes an error in measurement which is partially offset by the higher heating value of the gas.

The liquefied petroleum gas-air plants in operation in the Appalachian area vary from the simplest type of manually operated equipment to the more costly completely automatic plant. The simplest type plant consists of one or more tanks for storing the liquefied petroleum products in liquid form under pressure, a gas-fired vaporizer for changing the liquid to a vapor, and a manually operated inspirator valve for mixing the vapor with air at atmospheric pressure. Many of the more elaborate plants use equipment which automatically controls all plant operations from the heating value of the send out gas to the starting and stopping of the plant as required by the demand for gas.

The principle on which the plants made by the various manufacturers operate is fundamentally the same, the chief difference being the degree to which the plant is automatic in its operation; the method of applying heat in the vaporizer, i.e., whether it is direct fired or heated with steam and whether the liquefied petroleum vapor and air are mixed at atmospheric or a higher pressure.

Present Demand Problem

At the present time the demand for gas for new space heating in the Appalachian area is so great that some companies have asked for, and have been granted, the right to temporarily refuse to connect any additional heating loads under specific conditions. This has been done because it is the opinion of most gas company officials and others that local production, deliveries of gas from the southwest, storage and liquefied petroleum gas plants cannot be expanded rapidly enough to meet the anticipated peak during the winter of 1947-48.

Factors Affecting Cost of Peak Gas

Fixed and operating costs of pipe lines and liquefied petroleum gas plants can be determined quite accurately in advance. However, in the case of underground storage the investment required will depend upon the cost of finding, obtaining control, testing, equipping and reconditioning the storage field, which will vary from a very nominal amount to large sums of money. The actual out-of-pocket expense of operating underground storage plants is relatively small but to this must be added the cost of the gas put into the pool, particularly that part of the gas that must be left in the pool as a cushion. The investment in the cushion gas will, of course, depend upon the amount of gas required and the source from which the gas is obtained, i.e., whether the gas is obtained from the company's own production or by purchase.

Even in those cases where capital expenditures and operating cost can be accurately estimated, it is not possible to determine the unit cost of the peak gas delivered to the distribution plant because this cost will largely depend upon the load factor at which the facilities are used.

Advantages and Disadvantages

The principal advantages of underground storage are chiefly economic and freedom from the complex problems of serving a mixed gas. Its chief disadvantage is the fact that a suitable pool cannot always be found within a reasonable distance of the load center, even in gas producing areas.

On the other hand, the liquefied petroleum gas plant can be located almost anywhere, but the initial cost of the send out gas is much higher, and there are the disadvantages accompanying the furnishing of a mixed gas. In addition, wholesalers of propane and butane are facing a difficult transportation problem during periods of peak demand for these products. The installation of such plants by the natural gas utilities will add to this problem.

Conclusions

The underground storage of gas and the liquefied petroleum gas plant both are very necessary and successful tools of the gas industry in the Appalachian area today. Each has its place and under proper conditions both are practically indispensable.

Long pipe lines, liquefied petroleum plants, new off-peak uses and storage of one kind or another will all play an important part in the final solution of this difficult problem.

ELECTRICAL EQUIPMENT FOR OIL PIPE LINE PUMPING STATIONS

EXTENSION of electrical transmission lines to bring them within reach of nearly every pipe line station makes the problem of providing pump drive one of selecting units which will combine maximum throughput with greatest reliability and least power demand. Where motor drive is chosen, many factors must be evaluated to determine the type and size to be used. This article discusses electrical equipment and makes recommendations which should be incorporated in every station layout.

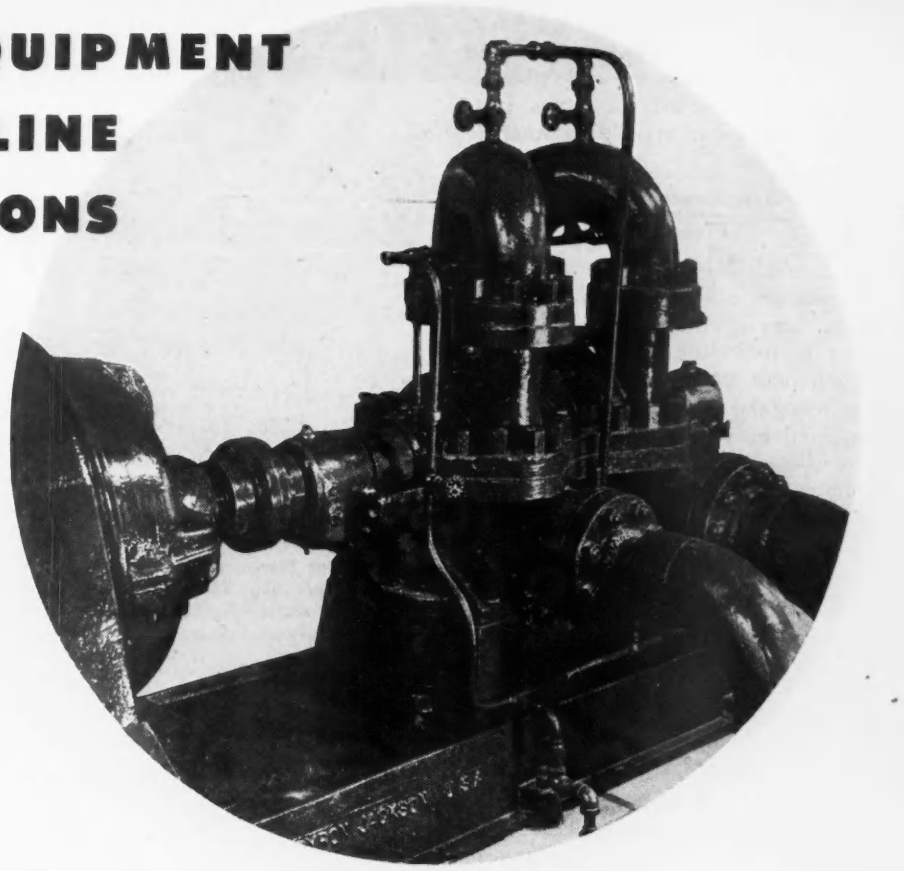


Figure 1. The centrifugal pump lends itself to direct motor drive, with only a flexible coupling interposed to absorb possible shaft misalignment. Explosion-proof motors may be mounted adjacent to pump unit, and troublesome firewalls thus eliminated

By W. G. TAYLOR

Industrial Engineering Division, General Electric Company

ALTHOUGH both centrifugal and reciprocating pumps are used for oil pipe line service, the introduction of a centrifugal pump that would handle oil efficiently greatly accelerated the use of electric drive for pipe line duty. The reciprocating pump is generally used when the volume of oil to be pumped is small—usually less than 20,000 barrels per day—or when the viscosity of the oil is high, usually above 400 seconds Universal Saybolt.

High-speed, motor-driven centrifugal pumps are comparatively small and light. They take up so little space that the pumping station can be kept very small. The units can be quickly installed and readily moved to new locations. The total investment at each station is therefore compartively low. The main motors for a pipe line pumping station are of tion, to take advantage of power-factor the constant-speed type. They may be either induction or synchronous motors, but induction motors are generally used. Induction motors are usually selected for centrifugal pumps, because of the high speeds at which such pumps operate.

Synchronous Motors

Synchronous motors are less often applied to pipe line service. When they are, it is often for power-factor correction, to take advantage of power-factor clauses in the electric-power contracts. However, an induction motor combined with a capacitor will serve the same purpose. Synchronous motors in standard designs are available for lower speeds than induction motors. The low-speed synchronous motors are especially suitable for reciprocating pumps.

An intelligent choice between induction and synchronous motors usually requires an investigation of their comparative prices, efficiencies and power factors. In the range of horsepower capacities and speeds required for main line service, either type of motor may be lower in cost or have better characteristics, depending mainly on the required horsepower and speed. An exception to this necessity for comprehensive investigation occurs when the chosen speed is 3600 revolutions per minute. For this speed, the cost of an induction motor is always much lower. This same cost advantage occasionally holds true where 1800 rpm is the chosen speed. Time required to obtain shipment is another

W. G. TAYLOR has been identified with the production, pipe line and refining divisions of the oil industry for more than 36 years as an industrial application engineer with General Electric Company. He devoted two years to the electrical problems of the Big Inch and Little Inch pipe lines prior to and during the period of their construction.

factor which may influence motor selection. While it is true that control for a synchronous motor costs a little more than for an induction motor . . . because an exciter is needed . . . this factor usually is less important than others.

Hazardous Gases Require Safety Precautions

The explosion hazards in gasoline pumping are obvious and widely recognized. Less attention has been paid, in the past, to explosion hazards in crude oil pumping. Many pipe line engineers now recognize that crude contains volatile fractions which will produce explosive gases if there be leakage into the pump room. Therefore, all pumping stations should be designed to minimize explosion hazards.

One way to promote safe pumping is to use explosion-proof motors in the pump room and to locate all of the electric control equipment in a separate room. This separate control room should be slightly pressurized to keep out any gases which might come from the pump room. This method does not apply to slow-speed synchronous motors because at present they are not available in explosion-proof designs. Explosion-proof induction motors are available in all sizes.

An alternative safety measure, which does not require explosion-proof motors, is a fire wall between the pumps and the motors. The control equipment should be located in the motor room, away from the pumps. This safety measure can be used in stations powered by either low-speed synchronous motors or induction motors.

Pumping Equipment Selection

From the standpoint of electrical equipment, a pipe line pumping station is a relatively simple installation. It involves only a few motors to drive the pumps, suitable control equipment for the motors, transformers for the power supply, overload and undervoltage protection, high and low hydraulic-pressure protection, lightning protection, and other simple devices. All the problems lie in the proper selection and coordination of the equipment.

Reciprocating pipe line pumps present no particular starting problem, because they are usually by-passed. Either a squirrel-cage or a wound-rotor induction motor will start the pump and readily bring it up to full speed.

When the high-speed centrifugal pump is driven by a squirrel-cage induction motor, the discharge valve must be closed during starting or, at most, cracked open only slightly. The motor can readily start the pump from rest,

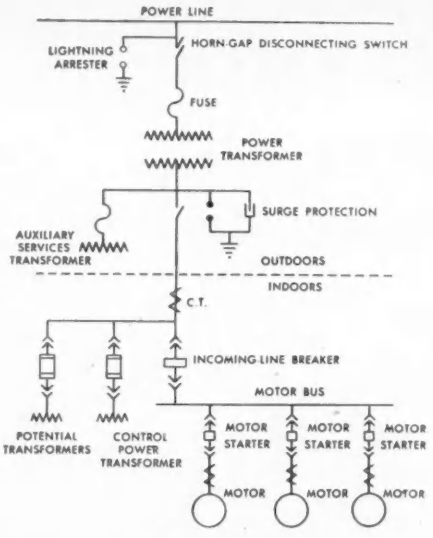


Figure 2. Power diagram of typical three-unit oil pipe line pumping station. Correct connection of operating and protective equipment leaves the station lighting source unaffected by pump drive difficulties.

even at reduced voltage, but it may have difficulty in accelerating the pump to full speed in a reasonable time, even if the discharge valve is closed. This difficulty arises from the fact that at around 75 or 80 percent of full speed, the torque available from the motor, and the torque required by the pump with the discharge valve closed, approach each other more closely than at any other speed. Conditions may develop which will seriously reduce the margin of motor torque over required pump torque.

With units designed for a synchronous speed of 3600 or 3000 rpm, the margin is less than for designs at lower speeds. This smaller margin at the higher designed speeds is a result of the inherent characteristics of two-pole induction motors. The excess of motor torque over required pump torque—at any speed below full speed—is the only torque available to continue acceleration up to full speed. If no excess is available, the acceleration will cease and the speed will "hang up" at the point where the excess disappears. If the excess is small, the acceleration rate is slow, and the time required for the unit to reach full speed is correspondingly lengthened. A long period of acceleration may overheat the motor.

At full motor voltage, there is always ample torque for acceleration at a reasonably fast rate, all the way up to full speed. When less than full voltage is available . . . because of voltage drop in the transmission lines, feeders and transformers, or because a reduced-voltage starter is used, or both . . . the accelerating-torque curve of the pump and the motor must be compared, to make sure that there is sufficient motor-torque margin for successful acceleration. This comparison is very important because motor torque usually decreases in proportion to the square of the voltage, and in some motors it decreases in even greater proportion.

Standard control devices, intelligently selected and coordinated, will provide completely successful pumping-station operation. The following factors must be considered: starting method, interrupting capacity of control equipment, selection of incoming-line circuit breakers, protection against hazardous gas conditions, lighting and auxiliary power circuits, power measurements, and the possible use of unit substations.

Full-voltage Starting Preferable

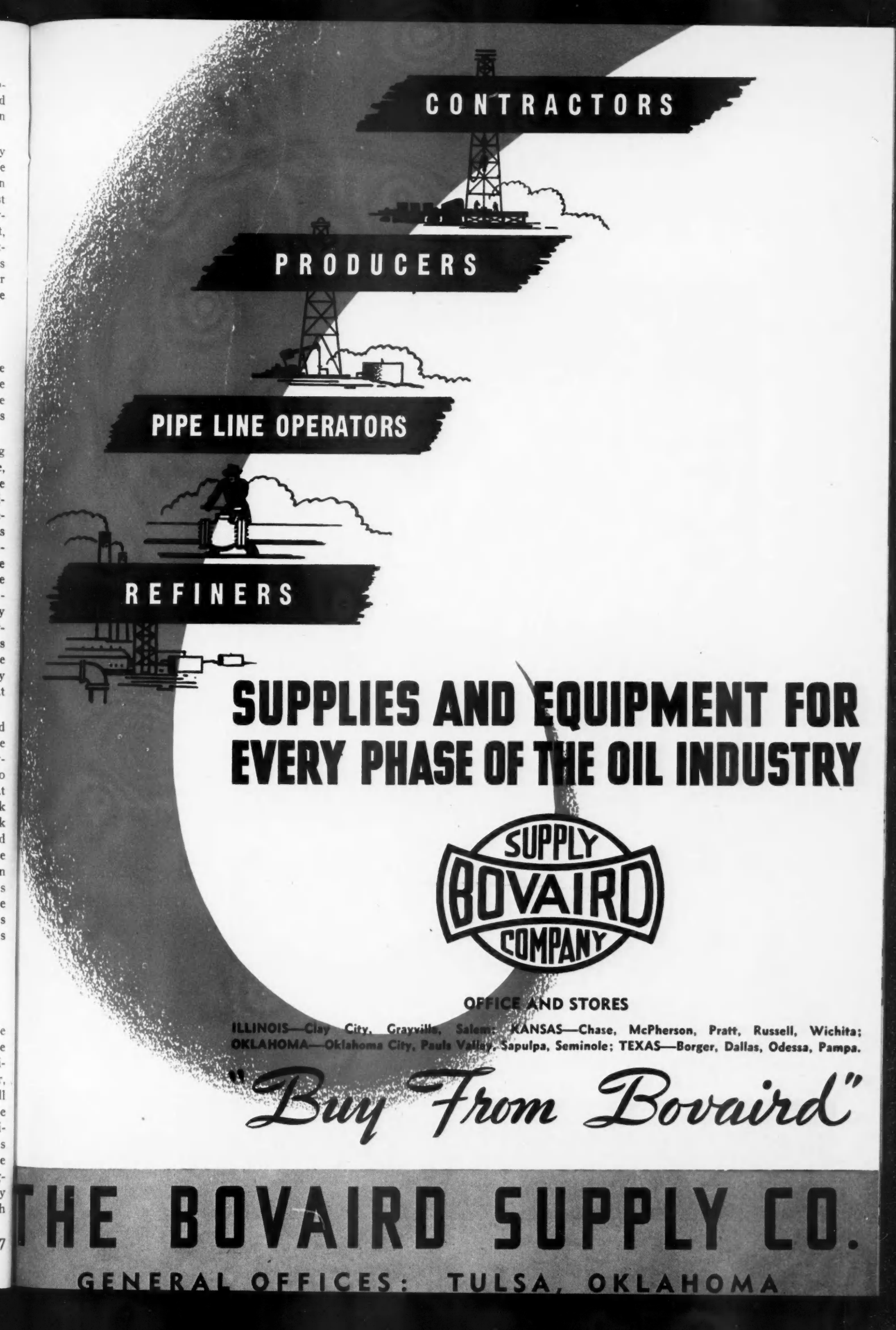
The starting current must not produce excessive voltage drop in the line. The voltage-drop problem can be more acute with reduced-voltage starting than it is with full-voltage starting.

There are two voltage peaks during the period of starting at reduced voltage, one at the instant of starting and the other when the motor is switched directly to the line. Correctly applied reduced-voltage starters keep these peaks low and thus minimize voltage disturbance on the power line. To keep the second peak as low as the first one, the motor must remain on the starting connection until it has accelerated to nearly full speed. Figure 3 shows that this current remains high until the motor has accelerated well above point A, the speed where the torque developed by the motor most closely approaches that required by the pump.

If the reduced-voltage starter should be adjusted to switch the motor to the line before point A is reached, the current on the second peak would jump to that shown on the full-voltage curve at the speed where this switching took place. The curve shows that this peak would be over 500 percent of full load current, making it much higher than the first peak, and nearly as high as when the motor is started at full voltage. Thus under such conditions, a full-voltage starter gives practically the same results as a reduced-voltage starter, and it has the added advantage of being cheaper.

Full-Voltage Starting May Be Necessary

Most pipe line pumping stations have more than one main pump motor. The last motor starts under the worst conditions. The starting of the last motor, after all the others are running at full speed and fully loaded, draws the heaviest current and causes the maximum voltage drop in the power lines and transformers. The greatest voltage drop usually occurs in the pumping-station transformers. This drop usually is so large that the motor is left with



SUPPLIES AND EQUIPMENT FOR EVERY PHASE OF THE OIL INDUSTRY

SUPPLY BOVAIRD COMPANY

OFFICE AND STORES

ILLINOIS—Clay City, Grayville, Salem; KANSAS—Chase, McPherson, Pratt, Russell, Wichita; OKLAHOMA—Oklahoma City, Pauls Valley, Sapulpa, Seminole; TEXAS—Borger, Dallas, Odessa, Pampa.

"Buy From Bovaird"

THE BOVAIRD SUPPLY CO.

GENERAL OFFICES: TULSA, OKLAHOMA

AROUND THE CLOCK

★ GEARED TO THE TEMPO OF EACH NEW DAY ★

Utility ELECTRIC POWER ★

Use Utility Electric Power!

PETROLEUM ELECTRIC POWER ASSOCIATION

Box 1498, Oklahoma City, Oklahoma

DEPENDABLE

UTILITY ELECTRIC *Power* SERVICE

You can be as sure of UTILITY ELECTRIC POWER service as night and day.

Dependability of service is only one of the many outstanding advantages.

Compressed to real facts, here's what you can be sure of . . . greater efficiency—at lower cost.

Call in the Power Engineer of your nearest Utility Electric Power Company to show you some amazing facts.

Use Utility Electric Power!

PETROLEUM ELECTRIC POWER ASSOCIATION

Box 1498, Oklahoma City, Oklahoma

only a relatively low voltage during its accelerating period.

The voltage drop when the last motor is started produces about the same effect as a reactor-type, reduced-voltage starter. The addition of a reduced-voltage starter, therefore, may not only be unnecessary, but it may reduce the voltage below the point required for successful motor and pump acceleration. Stations which have to operate under such conditions definitely require full-voltage starting. The line voltage is applied directly to the motor. The current drawn from the line by the motor being started is proportional to the voltage actually reaching the motor. The power system thus benefits in proportion to the voltage reduction.

If the power line is excessively "soft," reduced-voltage starting, as well as full-voltage starting, may cause an excessive voltage drop. This excessive voltage loss often can be remedied by the use of capacitors, or by a large-capacity power feeder, and perhaps larger transformers. Such measures require an increase in the interrupting capacity of the switching equipment. It is not always practicable to reduce fault currents by means of current-limiting devices, such as reactors, to a point where low-interrupting-capacity switching equipment can be used. Such a procedure may cause excessive voltage drop.

It is very important to realize that reduced-voltage starting often is attained without the use of a reduced-volage starter. Line and transformer conditions that cause considerable voltage drop actually result in the motor's being started at reduced voltage, even if the motor is connected directly across the line. Even when the power system is "soft," a reduced-voltage starter may still offer no advantages. On the other hand, full-voltage starting can be used when the power system is stiff. Therefore, the use of a reduced-voltage starter should be questioned in all cases.

Adequate Interrupting Capacity

The importance of adequate interrupting capacity in the control equipment cannot be overstressed. Failure to provide this capacity when the pumping station is designed can seriously delay pumping service, necessitate expensive repairs, and even endanger the safety of the station operator. The required interrupting capacity is governed by: (1) the amount of power available from the power system; (2) the current-limiting effect of the transmission and distribution lines; and (3) the kind of electrical equipment through which the current flows on its way from the power source to the point at which a fault occurs.

Short-circuit current is an increasingly important consideration in the selection of control equipment. Power systems have grown and the large horsepower requirements of the bigger pipe line pumping stations have correspondingly decreased the current-limiting effectiveness of feeders and power transformers.

When a fault current occurs, the switching device must automatically open the circuit without serious damage to itself. Other apparatus, through which the fault current may flow, must not be damaged during the time required to open the circuit. Damage resulting from a high current is due not only to excessive heat, but also to strong magnetic forces.

The costs for protection against the effects of heavy fault current increase in proportion to the size of the current. The projected installation must be carefully studied to determine the least expensive equipment that will afford adequate protection. Standardization of layout is not generally practicable. Each pumping station should be considered as an individual case. This is particularly true of major pipe lines which traverse the territories of several central-station power systems or more than one division of the same system.

Although the capacity of a power source may be large, the short-circuit current that flows at the point where motor protective switching is installed may be only moderate. The current is limited by the intervening electrical circuits, transformers, etc. These intervening lines and apparatus invariably produce a voltage drop. However, the voltage drop must not be great enough to interfere with the ability of the motor to start the pump and bring it to full speed.

Current-limiting must not be allowed to drop the voltage below a safe minimum. For this reason, a pumping station's switching equipment must have adequate interrupting capacity. This interrupting capacity usually requires better switching equipment than the cheapest devices that will carry the full load current.

Magnetic Contactors vs. Circuit Breakers

A magnetic contactor, within its operating range, opens a circuit in a much shorter time than a circuit breaker, but its interrupting capacity is relatively low. The circuit breaker, although slower, can be built for as high an interrupting capacity as is required. The contactor . . . with the exception of the latched-in type . . . is held closed magnetically. The opposing magnetic effect of high fault currents may force the contacts open. Although this danger may be reduced in the latched-in contactor, which is held closed mechanically, this type of contactor is available only in large sizes, is expensive, and has a shorter life than the conventional clapper-type contactor. Obviously, a main-line circuit breaker even with ample interrupting capacity will not adequately protect a magnetic motor starter with clapper-type contactors, since enough faul current may develop to force open the contactor tips. Damage results before the breaker has time to open a short circuit.

There are two ways of getting adequate protection:

1. Use circuit-breaker starters for each motor. This method is practicable only when starting is infrequent because circuit breakers are not designed for frequent operation. As a rule, pipe line pumps are started infrequently enough to make the use of individual circuit breakers possible.

2. For each motor, use a combination magnetic-contactor type of starter with current-limiting fuses. These fuses have high interrupting capacity. Since the fuses and their supports are designed for disconnecting service, separate disconnecting switches are unnecessary.

Method 2 has the advantage of relatively low cost, particularly when high interrupting capacity is needed. The fuses will successfully interrupt fault current on a 2300-volt line having an available short-circuit capacity on the order of 150,000 kilovolt-amperes. These fuses act faster than ordinary fuses, cutting off fault current in less than ¼ cycle (1/240 of a second), before a dangerous current level is reached. The short circuit is cleared in less than ½ cycle (1/120 second), thus limiting total energy to a low value. These fuses adequately protect the clapper-type contactors in the starter by making it unnecessary for the contactors to withstand the full short-circuit current that can be supplied by he feeder. Because their high interrupting capacity is practically never exceeded by the requirements of a pipe line pumping station, they give uniform protection in all stations at moderate cost. Their use virtually eliminates the necessity of studying individual short-circuit protection requirements at each pumping station.

Current-limiting fuses will not blow unnecessarily. They operate only under short-circuit conditions. They do not produce a voltage drop during normal starting and running. These enclosed, sealed fuses operate silently without emitting gas, flame or vapor. If blown, they give visual indication.

Transformer-Secondary Circuit Breakers

Transformer-secondary circuit breakers protect the transformers from overloads and make it possible to disconnect

20 YEARS "PUTTING PERMANENCE IN PIPE"

WE'VE COATED AND WRAPPED ENOUGH PIPE TO ENCIRCLE THE WORLD

In our twenty years of serving the pipe line industry, we've coated and wrapped enough pipe to encircle the world. That's a lot of pipe . . . it takes *130 million feet* to go around once and we're long since past that figure.

With this record, we feel that we know what it takes to "put permanence in pipe." It requires skilled workers (80 of the top hands in the business) . . . special equipment and plenty of it (over 20,000 square feet unde cover, with machines to handle every size) . . . ade quate storage space (74 acres of it) . . . convenien loading and unloading facilities (railroad sidings an paved roads) . . . a thorough knowledge of method and materials (here's that twenty years again) . . . and perhaps above all, a *sincere personal determination* t see that every job meets or exceeds specifications.

PIPE CLEANING, COATING AND WRAPPING TO ANY SPECIFICATION

mb **MAYES BROS., INC.**

HOUSTON, TEXAS

Write for Bulletin on Centrifugal Compressors
CLARK
MULTI-STAGE CENTRIFUGAL

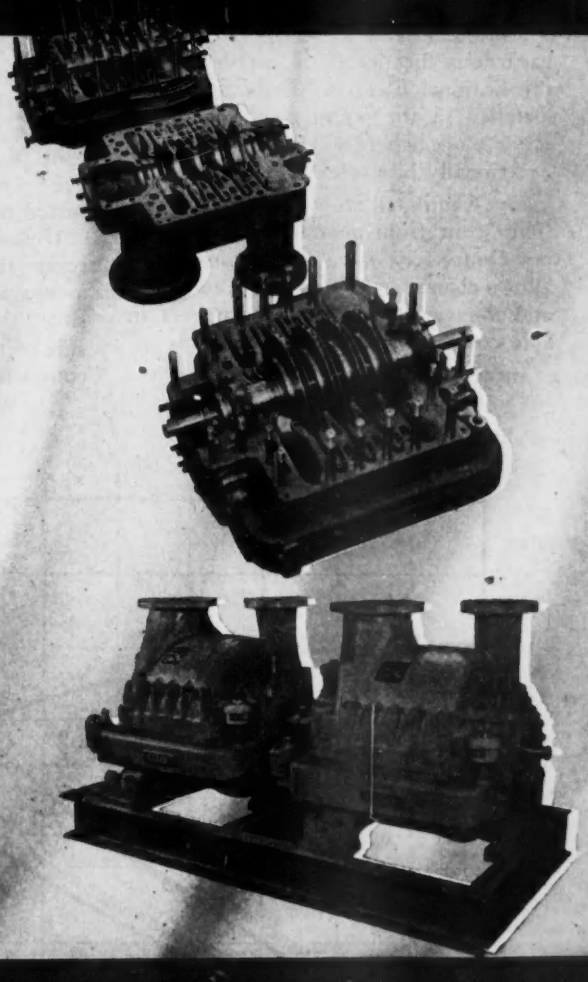
CLARK
CENTRIFUGAL COMPRESSORS
FOR HIGH PRESSURES AND LARGE VOLUMES

FEATURING STANDARDIZED DESIGN

An important feature of the Clark Centrifugal Compressor is the standardized design which permits use of interchangeable parts and easy adaptation from one type of service to another.

Another advantage of standardization is speed in filling orders for these units. Parts can be manufactured for stock and assembled for the particular specifications required.

The new Clark design features provision for through drive, which permits connecting two or more compressors in line, with one driver. This still further enhances the extreme economy of space achieved by these units. Write for full information.



CLARK BROS. CO., INC., Olean, New York

BIRMINGHAM, ALA. • BOSTON • CHICAGO • DETROIT • HOUSTON
LOS ANGELES • NEW YORK • SALT LAKE CITY • TULSA • WASHINGTON
LONDON • BUCHAREST, RUMANIA • CARACAS, VENEZUELA

CLARK

ONE OF THE DRESSER INDUSTRIES

SETS THE PACE IN COMPRESSOR PROGRESS

the station bus from the power supply. Disconnecting switches alone are unsuitable for breaking the magnetizing current of auxiliary transformers connected to the bus.

In some cases, the electric utility supplies the main transformers and the protective circuit breaker, and does not usually permit the pipe line company to operate or control the breaker for any purpose. When this is the case, the pipe line company can install an additional transformer-secondary breaker for bus disconnection and protection. When the pipe line company owns the transformers, one incoming-line breaker can serve all purposes.

When there is a fault in a motor circuit, it is more desirable to isolate that circuit than it is to shut down the entire pumping station. Adequate interrupting capacity in the starter for each motor circuit makes this possible. If suitable overload relays are used, the main breaker will not trip when there is a motor-circuit fault, yet it will open if a short circuit occurs between the starters and that breaker.

Motors suitable for Class 1, Group D, hazardous locations . . . as defined by the National Electrical Code . . . can be installed in the pump room or in any other place where explosive gases may occasionally be present.

Pipe-ventilated motors, which use ventilating air from an outside source, are not completely safe. Their construction allows chance sparks or flames to escape, and the ventilating air will support inside combustion.

Inert-gas-filled motors, with closed, water-cooled ventilating systems, are safer than pipe-ventilated motors. They can be obtained in larger sizes than are available in the type of construction approved for Class 1, Group D conditions.

Open motors are preferred by some pipe line companies. For maximum safety, these open motors should be coupled to the pumps through a sealed fire wall. Motors and control can then be in one well-ventilated room, adequately sealed off from the pump room.

If the main motors are in the pump room, the control equipment is safer in a separate, well-ventilated room. If possible, this room should be at the far side of the station from the pumps. The complete isolation of all the control equipment is more economical than the use of explosion-proof starters in the main pump room. Explosion-proof starters are more expensive than ordinary starters, and a separate control room is needed in any case to house the incoming line panel and metering equipment. The control room has better protection from explosive gases if it is located on the windward side of the building with respect to the pumps and manifolds.

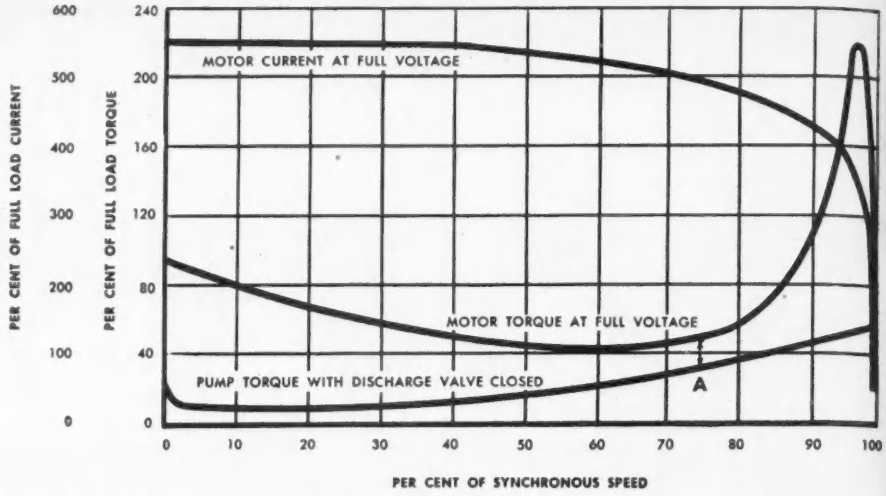


Figure 3. Comparison of motor and pump torques for starting conditions. Suppression or reduction in second starting voltage peak through proper starters will reduce disturbance and provide better operating characteristics.

Year-round Ventilation

The motors in a pipe line pumping station often produce more heat than is necessary to heat the motor room. There must be ample ventilation to remove this heat in summer and to control it in winter. Year-round ventilation prevents high ambient motor temperatures and makes the station comfortable for the operators. Dissipation of motor heat and adequate ventilation together require a flow of fresh air into the station greater than the flow of room air through the motors. The necessary intake of fresh air is roughly 12 cfm per installed hp.

Unit substations are complete and ready to install. They come in one or more complete sections, ready to bolt together and connect to the power cables. Their compactness saves space, and they look better than equipment assembled piecemeal. All parts are fully coordinated by one manufacturer, assuring successful, dependable performance. All live parts are metal-enclosed.

Different power suppliers have different incoming-line arrangements for oil pipe line pumping stations. Sometimes the power company supplies the transformers, and meters the power on the secondary side. Sometimes the pipe line company buys primary power and supplies the transformers. In some cases,

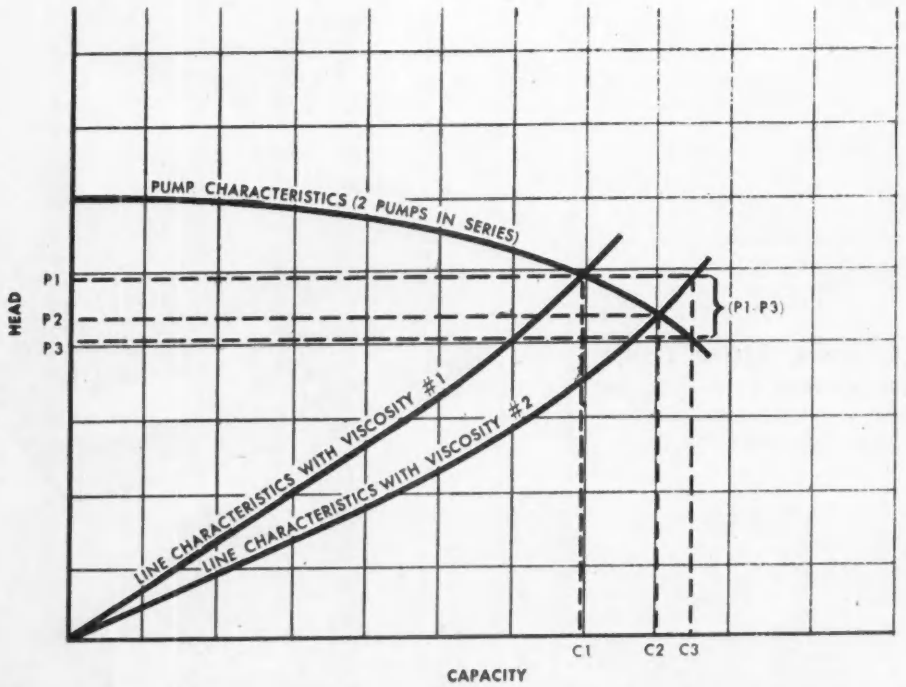


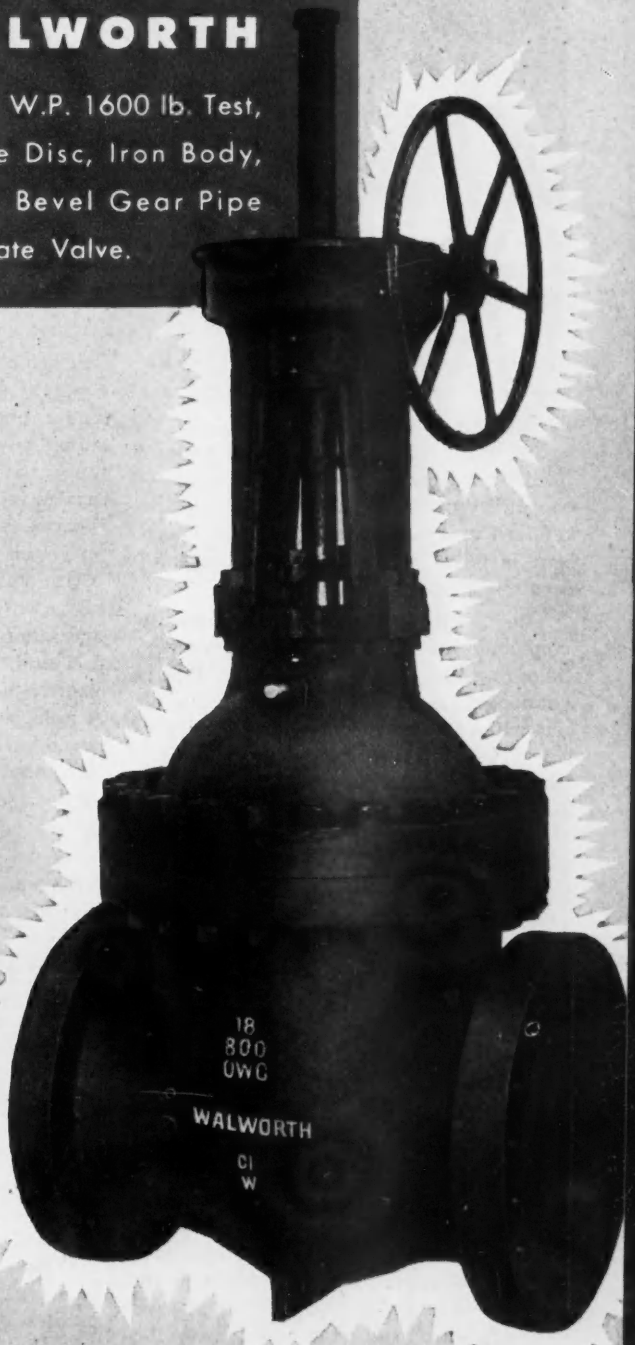
Figure 4. Pipe line characteristics with oil at two different viscosities, illustrating amount of pressure (or volume) makeup required to insure continuous full-capacity throughput.

LINE EQUIPMENT

KNOWN PERFORMANCE

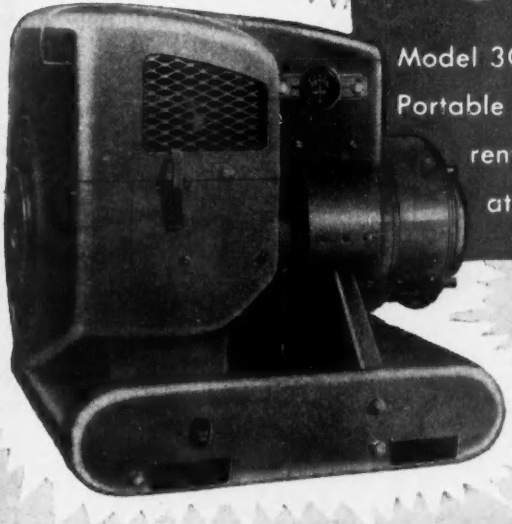
WALWORTH

800 lb. W.P. 1600 lb. Test, Double Disc, Iron Body, OS&Y, Bevel Gear Pipe Line Gate Valve.



ONAN

Model 3CK, 3,000 Watts, Portable alternating current Electric Generating Plant.



CONTINENTAL

SERVING THE OIL AND GAS INDUSTRIES

THE CONTINENTAL SUPPLY COMPANY, General Offices: DALLAS, TEXAS • EXPORT DIVISION: 30 Rockefeller Plaza, NEW YORK, N. Y.

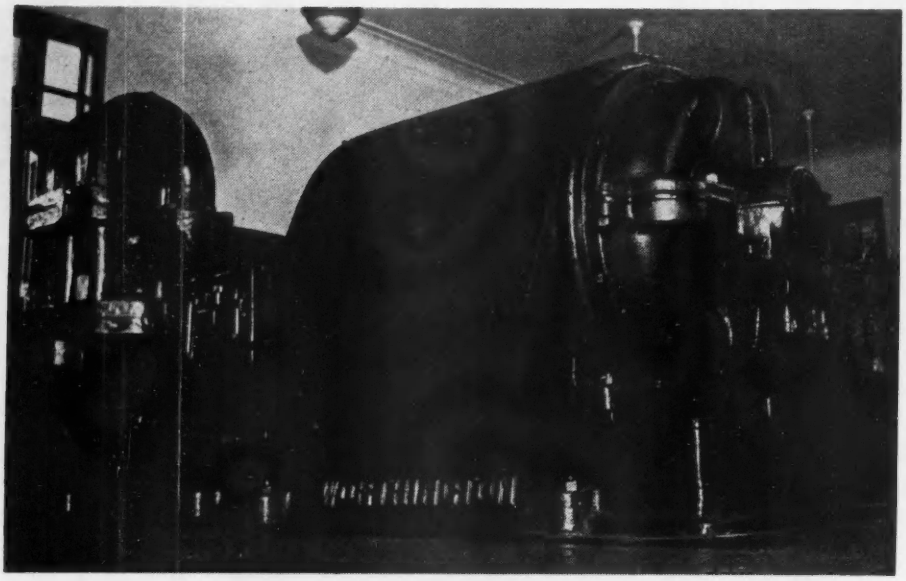


Figure 5. Self-ventilated motors, circulating station air through vents formed within the motor shell, require the admission of outside air to enable operating temperatures to be kept within limits. Such a compact installation is readily kept clean and as readily inspected.

suitable transformers are already available and it is not necessary to purchase new ones.

Completely new equipment is usually needed, however. Whether purchased by the utility or the pipe line company, the modern unit substation makes an excellent installation and offers a choice of incoming-line arrangements.

The lighting transformer is usually connected to the power circuit on the incoming-line side of the breaker. If it is connected on the load side, the lights go out when the breaker is open. The lighting transformer, which is usually out-of-doors, should have suitable protection. General lighting safety precautions include approved wiring methods, and vapor-proof lighting fixtures. When the lighting transformer is ahead of the main breaker, a separate bank of transformers, connected on the load side of the main breaker, supplies low voltage to auxiliary motors. This separate bank of transformers is thus disconnected during emergency shutdowns. They may be mounted indoors or out, as preferred.

A pipe line pumping station requires few power-measuring devices. A watt-hour meter on the incoming line measures power consumption. A voltmeter indicates whether the power lines are energized, and whether the voltage is normal. An ammeter, for each main pump motor, shows the load on the pump. An incoming-line ammeter may also be used, if desired. A few additional instruments are needed for the d-c field circuits of synchronous-motor drives.

Motor-Driven Booster Pumps

Some pipe line engineers object to the centrifugal pump because its head-capacity curve has a drooping characteristic which prevents it from maintaining constant pressure at different capacities. These engineers feel that a main line should always be operated at its maximum safe pressure so that there is maximum pumpage throughout the year, regardless of variation in the viscosity of the oil pumped.

Undoubtedly it is desirable to maintain constant pressure under different operating conditions. It is possible to do this and still enjoy the advantages of electric-motor-driven centrifugal pumps. A relatively small single-stage booster pump, driven by a wound-rotor induction motor, used in series with the main pumps, will maintain a constant pressure.

Assume that viscosity 1 in Figure 4 represents the winter conditions and that viscosity 2 represents summer conditions. These two viscosities may also represent two different grades of oil, but the results in either case will be the same. It is evident from the curves that when the viscosity drops, the capacity goes up and the pressure drops. If P1 is the maximum allowable pressure, it is obtained when oil with the highest viscosity is pumped through the line. P2 is less than P1 although capacity C2 is greater than capacity C1. However, when pressure P1 is maintained while the lower viscosity oil is pumped, capacity C3 is obtained. This capacity is greater than either C1 or C2.

If the two viscosities indicated are the maximum and the minimum that the pumping station can handle, a booster pump capable of handling full capacity with a maximum head equal to P1 minus P3 will boost the line pressure to maximum at the minimum viscosity (viscosity 2). The station can then deliver capacity C3 instead of capacity C2.

The pressure of a centrifugal pump varies as the square of the speed. Varying the speed of a variable-speed, motor-driven booster pump maintains full station pressure, P1, during the pumping of any oil with a viscosity between the maximum and minimum values handled by the line. For example, a pipe line handling 50,000 barrels of oil per day has two main 400-hp motor-driven pumps in each station, each pump operating at a load of approximately 360 hp. P1 minus P2 is about 70 pounds. P1 minus P3 is about 75 pounds. A single-stage booster pump is installed to handle full capacity at 75 pounds pressure. This pump requires a 75-hp motor. At summer viscosity, all three pumps operate to maintain full-time pressure, with a total station load of approximately 795 hp. In winter, the booster pump is shut down entirely. During fall and spring, the booster pump is run at the appropriate speed to maintain maximum allowable line pressure. Although the motor efficiency is comparatively low at reduced speed, the effect on over-all station efficiency is negligible because the booster pump and motor are relatively small.

The station operator controls the booster-pump speed. He adjusts it to maintain constant station-discharge pressure at all times. The booster pump requires only infrequent adjustment. It can be adjusted automatically, if desired, by using the line pressure to control an automatic pressure switch.

Pressure control by means of booster pumps allows the pipe line designer considerable flexibility. If, due to inaccurate estimates of viscosity, a station is not placed at exactly the right place on the line, the booster pump will fully compensate for the error.

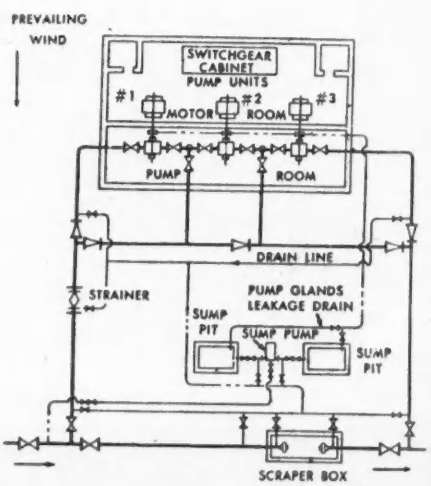
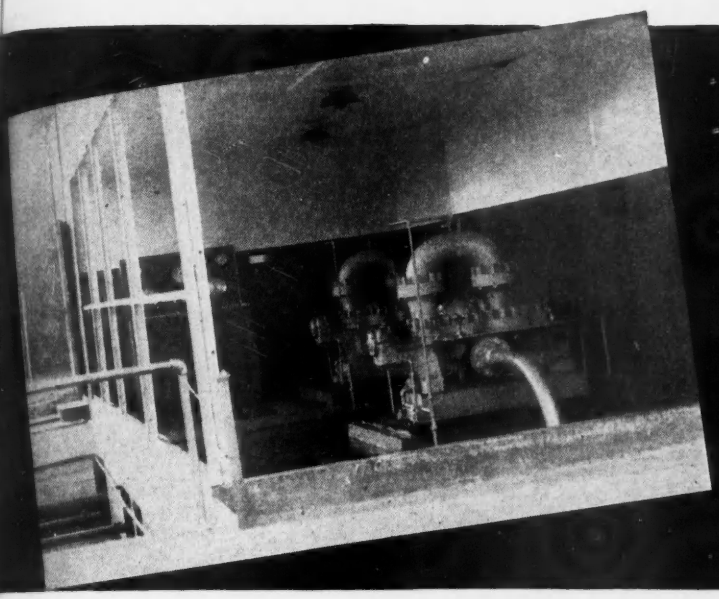


Figure 6. Layout of typical three-unit oil pipe line pumping station, with desirable location with regard to wind (natural ventilation) included in setting. Where the wind and line trend do not align satisfactorily, artificial draft or ventilation is frequently advisable.

SPECIAL!



Sale!

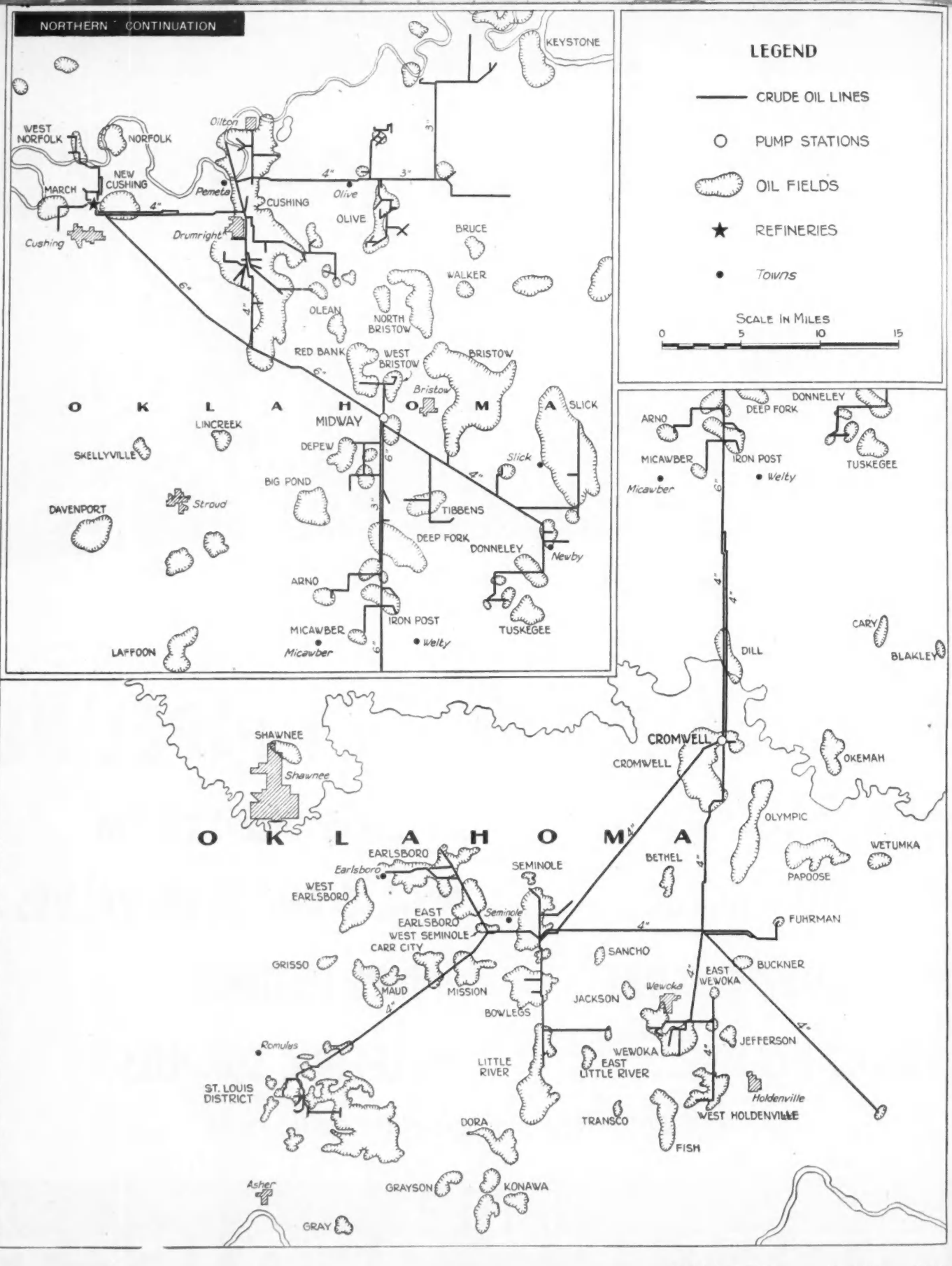
FLORIDA EMERGENCY PIPELINE

- DIESEL ENGINES
- ELECTRIC MOTORS
- AIR COMPRESSORS
- LIGHT PLANTS
- TELEPHONE SYSTEM
- GATE AND PLUG VALVES
- PIPE FITTINGS
- ELECTRIC SUPPLIES

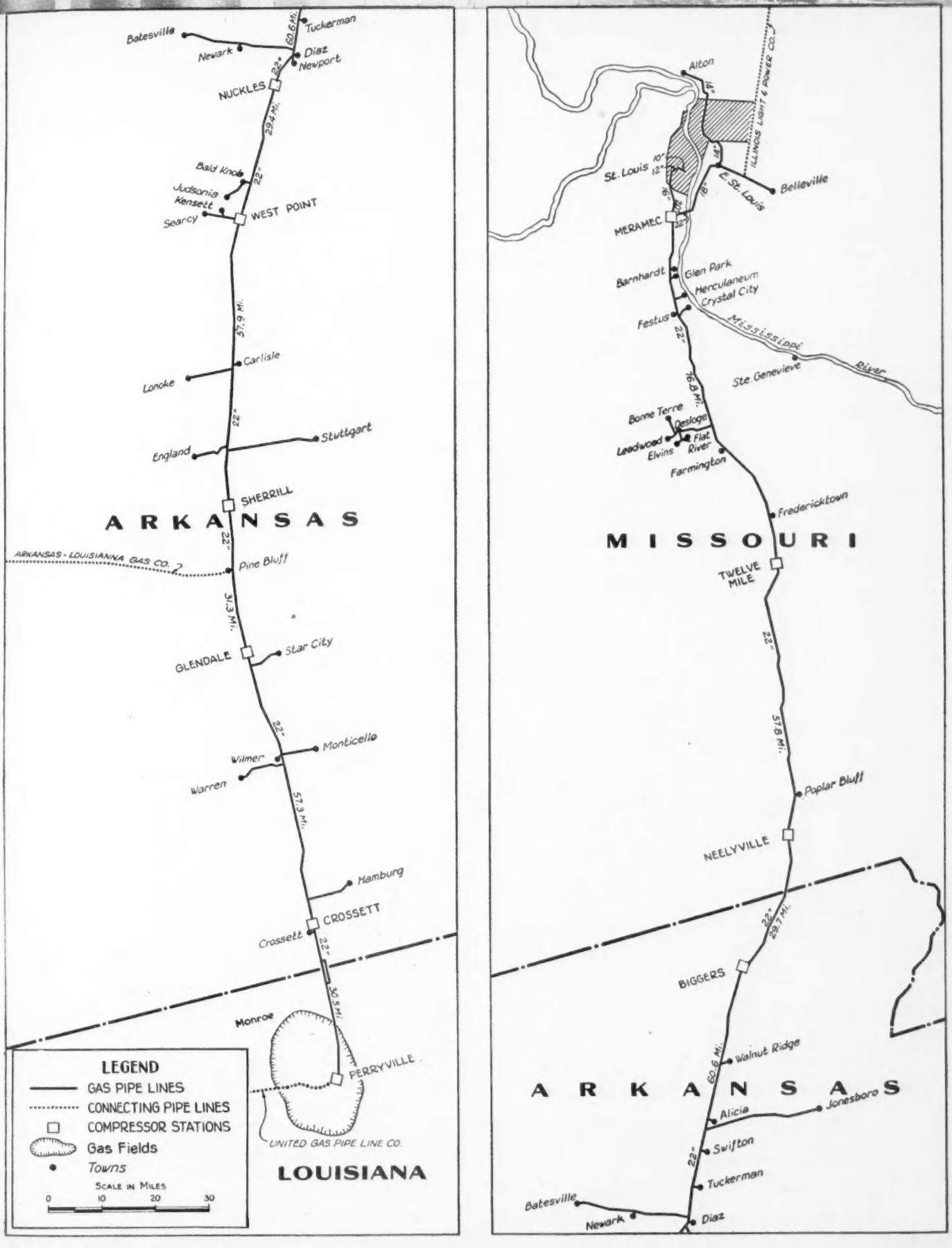
and other items of pipeline equipment

PIPELINE PROJECT

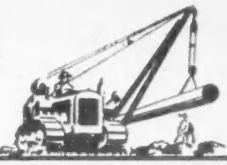
Deep Rock Oil Corporation



Mississippi River Fuel Corporation



PIPE LINE *Construction News*



2255 Miles of Pipe Line Planned from Mid-August Through Mid-September

FROM mid-August to mid-September approximately 2255 miles of pipe line construction was planned. Most of these plans were in the active stage, with only two lines delaying until 1948.

That the number of miles to be laid was not larger could be explained by several factors: hesitancy in the North and East to begin projects at this season which might be delayed by early winter, and the usual difficulty in obtaining pipe. Reconditioning activity was noticeable, many companies now taking up lines to be used where demand in other areas has to be satisfied somehow.

This was the situation with Cities Service Gas Company in Oklahoma. Earlier in the year the company made expansion plans which could not be fulfilled because of the pipe shortage. By midsummer the company had decided to abandon approximately 257 miles of various-sized lines, including its entire system in Pantotoc, Seminole, Hughes, Okfuskee, Lincoln, and Creek counties that connected to its Drumright station because the supply of gas was greatly diminishing, and announced plans for reclaiming the pipe to use in new lines and as replacements. Oklahoma Natural Gas Company agreed to connect its system to the wells being abandoned, and will sell the gas to Oklahoma Gas Service Company. Cities Service hopes ultimately to increase its gas system capacity by a daily total of 370 million cubic feet through a 400-mile, 26-inch natural gas line from the Hugoton field across the state of Kansas. Officials have announced plans for further facilities and a compressor station near Ulysses, Kansas, that will cost $36 million.

Magnolia Pipe Line Company's crude project from East Texas to Illinois, now in final stage of completing, was the most important work under way. It is at present the largest postwar line being built by a single company and is of extreme importance to the Midwest oil supply.

Most of the month's activity was centered in the Midwest and North Central states, indicating the increasing demand for fuel in those areas. Shell Pipe Line Corporation and The Texas Pipe Line Company in consequence have planned a $22 million line from Oklahoma to Illinois. The new line will provide transportation beyond Cushing for part of the throughput from the New Mexico-West Texas-Cushing line now under construction. The new line will be about 500 miles long, with the 20-inch section owned jointly by Shell and Texas in undivided interests of 52 and 48 percent, respectively. The 16-inch portion will be owned entirely by Texas. The line will parallel an existing double ten-inch line between Cushing and Wood River.

Next longest pipe line mileage was the looping projects of TGT in Louisiana, Tennessee, Mississippi and East Texas. The work presently being done by Latex Construction Company is a part of the huge $55 million construction program planned over the 1265-mile system. Aside from a new experimental compressor station to be constructed near Morehead, Ky., at a cost of $477,000 which will enable the company to greatly increase supplies to the Appalachian district this winter, a major project is an aerial crossing of the Mississippi River near Greenville, Miss., that will be the largest in the world. The crossing will carry the 83-mile, 20-inch line from the Carthage field, East Texas, to Natchitoches, La. The crossing, 11,676 feet long, will carry three 26-inch lines. Looping of the 26-inch lines east of the Mississippi will require a total of more than 600 miles of pipe. This is in addition to looping in progress west of the Mississippi.

The only products project recently announced was Socony-Vacuum Oil Company's 127-mile line in Maine, designed to assure a steady supply in winter and replace barges in transporting gasoline, kerosine, and fuel oil from the company's marine terminal. Another line, announced in June by Portland Pipe Line Company, between Portland and Montreal, Canada, is being held up by lack of materials.

NEW PIPE LINE PROJECTS

COMPANY	Origin and Terminus	Length (Miles)	Pipe Size (Inches)	Daily Capacity (Bbls., Cu. Ft.)	REMARKS
CRUDE OIL LINES					
Great Lakes Pipe Line Co.	Osceola to Council Bluffs, Iowa	120	6	.....	A. C. Holder Construction Co. awarded contract to take up and recondition line.
Humble Pipe Line Co.	Satsuma station to Baytown refinery, Upper Texas Coast	40	20	.....	Latex Construction Co. awarded contract.
Magnolia Pipe Line Company	Corsicana terminal, E. Texas, to Patoka, Illinois	647	20	100,000	Work scheduled for completion November, 1947. Contractors: Oklahoma Contracting Co. (4 sections, 428 miles); H. C. Price Co. and Eastern Construction Co. (111 and 108 miles, respectively).
Mid-Continent Pipe Line Co.	St. Louis pool via Lindsay, Maysville, Antioch to Eola, Oklahoma From new line to Pauls Valley, Oklahoma	50 14	6 4	7,500	New line plus modernization and expansion of facilities to cost $2 million. Capacity of line will eventually increase to 12,500 barrels per day.
Shell Pipe Line Corporation	Kilgore station to junction south, in E. Texas	16.2	10	.....	Wood Engineering and Construction Co. has contract to recondition line; scheduled completion date mid- Sept.
Shell Pipe Line Corp. and The Texas Pipe Line Co.	Cushing, Oklahoma to Wood River, Illinois Wood River to Salem, Illinois	439 61	20 16	150.,000	Project will cost $22 million plus. Will be constructed and operated by Shell.
Standish Pipe Line Co.	Crowley County, Kansas to Yale, Oklahoma	50	8	.....	Bishop & Locke Construction Co. reconditioning part of the Oklahoma City to Kansas City line.
Stanolind Pipe Line Co.	Adair field to Texas-New Mexico Pipe Line Co. line in West Texas Hamilton Dome to Elk Basin-Casper line in Wyoming	6 13½	6 8	 7,000	Construction authorized. Construction approved by Wyoming Public Service Committee; to start immediately.
	Spoon River to Garfield junction, LaSalle County, in Ill.	45.8 15.1	20 22	....	Contracted by J. R. Horrigan Construction Co. Work in progress.

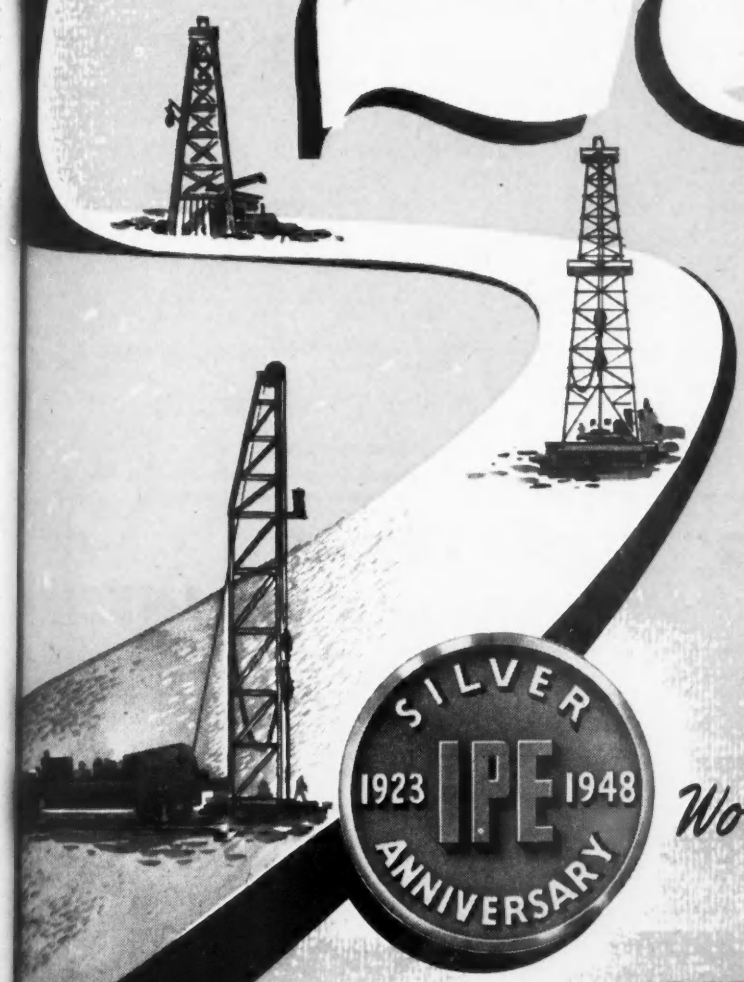
■ CONTINUED ON PAGE 220

From 1923 *to* 1948

25 *Years*

OF OIL PROGRESS

- EXPLORATION
- DRILLING
- PRODUCTION
- TRANSPORTATION
- REFINING
- MARKETING



Worlds Fair of the Oil Industry

Plan now to attend the greatest exposition in the world devoted to a single industry — oil.

For information write:
Wm. B. WAY, General Manager

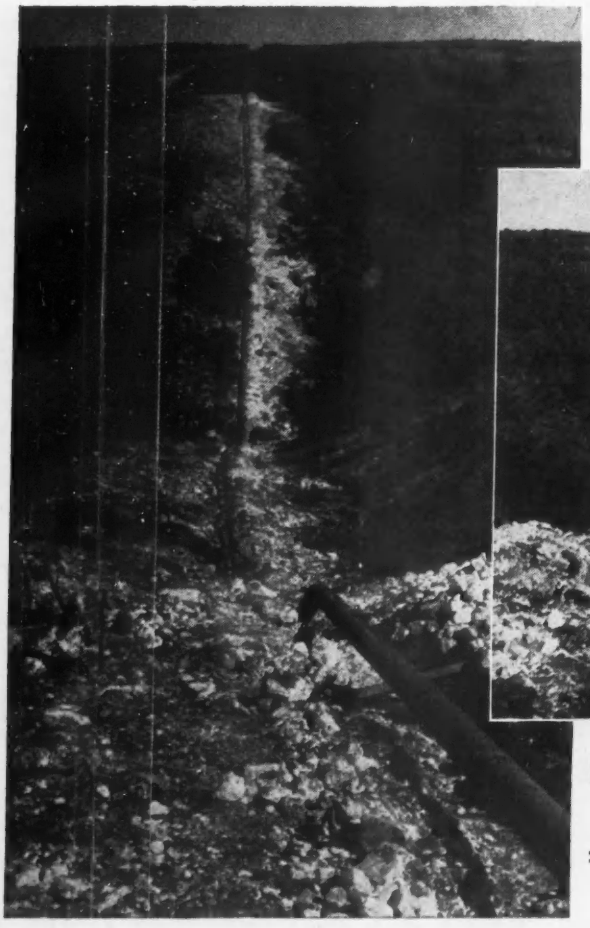
INTERNATIONAL PETROLEUM EXPOSITION

TULSA, OKLAHOMA, U.S.A., MAY 15-22, 1948

New Pipe Line Projects

■ CONTINUED FROM PAGE 218

	Freeman to Outer-Belt junction, in Mo.	18	8	.....	McVean & Roberts Pipe Line Construction Co. taking up and reconditioning line. Scheduled completion date October 10, 1947.
The Texas Pipe Line Co.	Antioch pool to Velma pool, Oklahoma	23	8	.....	Construction awarded to C. L. Rogers Construction Co.
PRODUCTS LINE					
Socony-Vacuum Oil Co.	South Portland to Hallowell Hallowell to Bangor, Maine	61 66	6 4	11,500	Line plus all facilities to cost nearly $1 million. Construction will begin in 1948.
NATURAL GAS LINES					
Cities Service Gas Co.	Barnsdall, Okla., to point south of Bartlesville	17	16	.....	Permian Basin Construction Co. is finishing laying of line
	Drumright to Little Oklahoma, Oklahoma	51	16	.....	Deaton & Sons Pipe Line Construction Co. has contract to take up, condition and rack. Scheduled to complete October 20.
	Guthrie to Oklahoma City—Drumright trunk line	...	...	.....	Company is tearing up lines in southern part of Greater Seminole area for materials to use in new project. Construction to start immediately so company can meet peak demands in winter. Cost estimated $881,000.
Dow Chemical Company	Headquarters field to Loomis, Michigan	29	6	.....	Somerville Construction Co. has completed.
East Ohio Gas Company	Mullet Farm to Ross Farm valve stations, Ohio	84	20	.....	FPC has authorized project. Company will take additional gas from Big Inch systems at estimated cost of $3.2 million.
Lone Star Gas Company	Breckenridge to Ranger, West Texas	21	16	.....	McVean & Roberts Pipe Line Construction Co. taking up and reconditioning line.
Mt. Fuel Supply Company	From trunk line to Provo, Orem, Springhill, Lincoln, Spanish Fork, Utah	35	..	.....	Construction to start in Spring 1948. Will cost estimated $850,000.
Northern Natural Gas Company	Sunray to point 20 miles northeast Borger, Texas, Panhandle	40	16 & 20	.....	R. H. Fulton & Co. has started work on this line.
Pacific Gas and Electric Company.	Sunnyvale to Redwood City, California	22	20 & 24	.....	Contract awarded to Pacific Pipe Line & Engineers, Ltd. for completion December, 1947.
Panhandle Eastern Pipe Line Co.	Howell field to junction with main line, Michigan	19	10	10-15 mln	Permit approved by Michigan Public Service Committee.
Signal Oil and Gas Co.	Long Beach to Signal Hill, California	3⅛	22	.....	Pacific Pipe line & Engineers, Ltd. awarded contract.
Southern Natural Gas Company	Birmingham, Alabama, vicinity	19	20 & 22	.....	Latex Construction Co. has contract for series of loops. Work in progress.
Tennessee Gas Transmission Co.	Como, Mississippi, to Selmer, Tennessee	120	26	.....	Latex Construction Co. has completed approximately 75 miles of loop line.
	Carthage, E. Texas, to Main Line at Natchitoches, La.	73	20	.....	Latex Construction Co. will begin construction soon.
United Gas Pipe Line Company.	Gwinville field to junction with Jackson-McComb 6-in. line near Brookhaven, Mississippi	36	6	.....	Company has acquired right of way.



12" WEST TEXAS OIL LINE

BUILT BY LATEX CONSTRUCTION COMPANY, 1947

LATEX CONSTRUCTION COMPANY

General Contractors

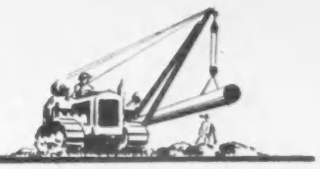
OIL — GAS — GASOLINE — WATER PIPE LINES

2707 FERNDALE PLACE ORGANIZED 1936 HOUSTON, TEXAS

Laurence H. Favrot Geo. A. Peterkin J. W. Sharman

How to do it!

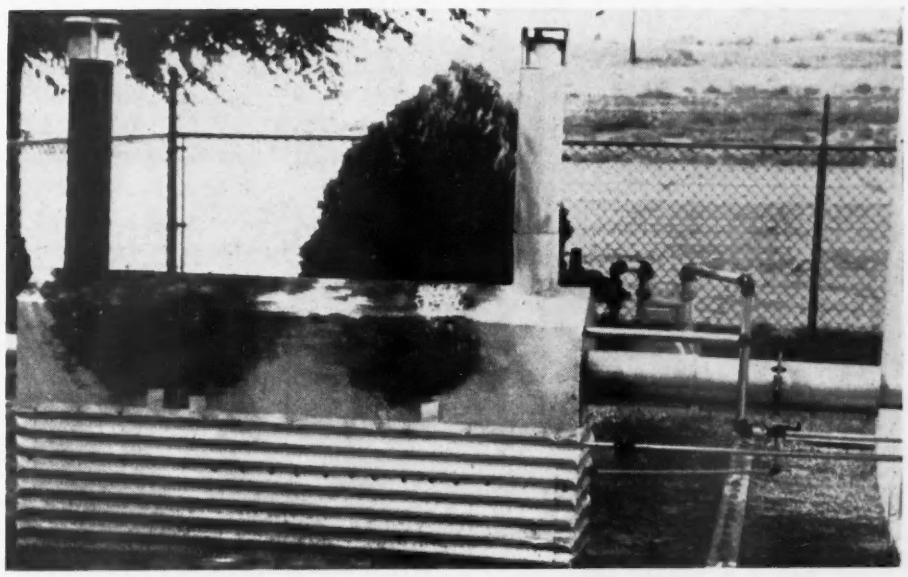
PIPE LINE HINTS



$10.00 is paid for each illustrated acceptable contribution. Mail to The Editor, WORLD OIL, P. O. Box 2608, Houston 1, Texas

How To—Prevent Accumulation of Hydrates in Gas Line Meter Run

In areas where the winter temperatures are severe, it is necessary to provide a means of preventing hydrates from forming in the meter run, in as much as such hydrates may not only clog up the orifice plate, but would also produce erroneous readings. One gas company buying field gas and metering it into a residential area overcomes this difficulty by providing a heater on the meter run ahead of the orifice plate. Not only does heating the gas prevent the formation of hydrates, but it also places the gas temperature within the range of the meter correction charts which make it easier to calculate volume on a given base.



The installation shown consists of a small sheet metal housing constructed around a segment of four-inch meter run immediately upstream of the orifice meter plate. The sheet metal is supported by a frame of light-weight angle iron welded to the form illustrated. Perforated pipe burners are supported on racks beneath the pipe, and are supplied with gas from the downstream main. Pressure has been reduced through regulators which drop the main line pressure to burner pressure.

Two stacks made from stove pipe provide ample draft, while the enclosure distributes the heat throughout the entire length of the housing. Roof of the heater is water proof to prevent entry of rain, while the enclosed sides keep winds from blowing the fires out. The meter run into the meter house is jacketed with asbestos enclosed in sheet metal in order to maintain the temperature of the gas.

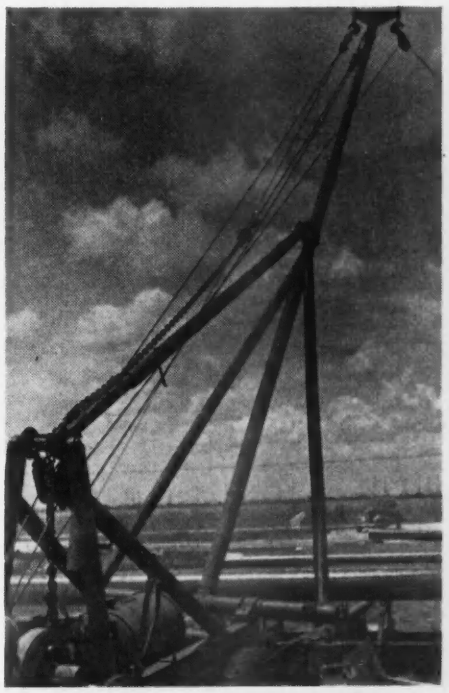
How To—Handle Large Diameter Pipe

At loading terminals or in pipe yards, a portable hoist suitable for handling every size of pipe must be available. An efficient hoist for this purpose is the truck-mounted type obtaining its power from the truck engine.

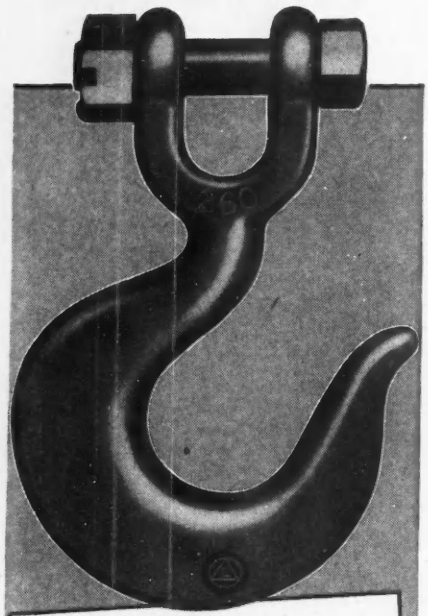
Such a unit is illustrated with only the rear end of the truck and hoist system in view. The hoisting unit is mounted on an I-beam skid which is bolted directly to the truck frame. The supporting beam is made of four-inch extra-heavy pipe with an extension section of three-inch which telescopes inside the four-inch beam. Three-quarter-inch holes drilled through both pipes make it possible to adjust the length of the beam as the job requires. The hoisting beam is mounted on a perpendicular section of four-inch pipe which is pivoted on the end of the I-beam skid and strapped in a saddle. Angle braces of four-inch pipe welded to both sides of the hoisting beam prevent side-wise movement during lifting operations.

Two anchor posts about four feet high and braced to the winch end of the skid are connected to the hoisting beam by a telescoping arm consisting of 2½-inch pipe and three-inch pipe. Holes drilled through both pipes provide a means of adjusting the length of this link to raise or lower the hoisting beam.

A short "tee" welded across the extended end of the hoisting beam is fitted with eyes into which are hooked the two steel single-sheeve pulleys. Dual hoisting lines are strung through the pulley system so that a line can be hooked into each end of the pipe being handled. The lines lead to two winch drums driven by a common shaft. The control levers are placed so that the operator can view the entire operation. The tank shown mounted on the skid contains gasoline for the truck engine.



FITTING NEWS!



NEW CLEVIS HOOK BY LAUGHLIN OFFERS UNIQUE ADVANTAGES

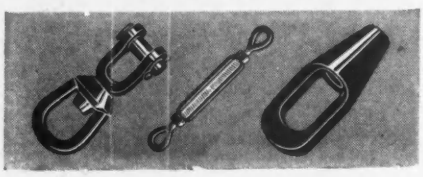
- **QUICK** and easy to attach with bolt, slotted nut and cotter. No welding . . . no special fittings needed.
- **SAFE** . . . meets highest safety requirements . . . hook and bolt made of drop-forged, heat-treated steel.
- **EASY** to change . . . easy to switch from job to job as needed.
- **FITS** wire rope . . . chain . . . many block straps.
- **SUPPLIED** with Safety Latch or with reversed jaw on special order.

Send for Catalog No. 140

THOMAS LAUGHLIN CO.
DEPARTMENT 23, PORTLAND 6, MAINE

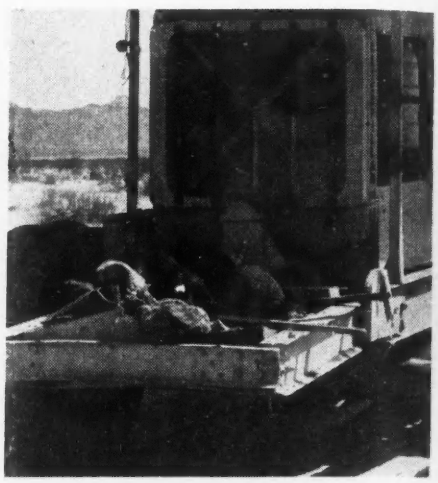
LAUGHLIN

THE MOST COMPLETE LINE OF DROP-FORGED WIRE ROPE AND CHAIN FITTINGS



PIPE LINE HINTS

How To—Carry Tools on Pipe Line Trencher



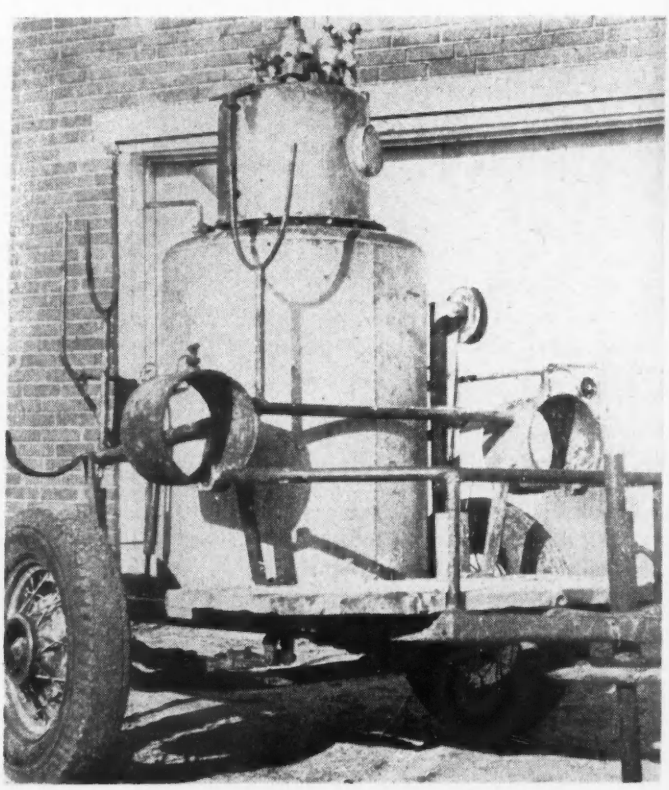
Keeping track of miscellaneous tools on a pipe line construction job is always a problem. Because the trencher moves steadily down the line, it is desirable to keep some tools with it to handle special jobs.

One pipe line contractor provides a retractable rack or bin on the trenching machine for the purpose of carrying loose items such as shovels, picks, hammers, miscellaneous pipe fittings, etc. Any operation of the trencher requiring any of these items is completed with no lost time in searching for the tool since they are carried along with the trencher.

The bin is made from six-inch I-beams which form the side pieces, to which have been bolted a cross piece of four-inch channel iron forming the end. The bottom is of ⅛-inch sheet steel welded to this framework. The I-beams are pivoted to the trencher frame by a short section of steel rod. Two plates cut to form by a cutting torch are bolted to the trencher frame to receive the rod.

When in the horizontal position, the two I-beams butt against the frame of the trenching machine and thus support the bin. When the trenching machine is moved to another area by trailer, truck or freight car, the bin is folded up against the radiator of the trenching machine engine and is tied in this position until needed on the next job. It forms a handy means of keeping up with tools as the trenching machine progresses down the line without having to carry these items by hand.

How To—Provide Portable Supply of Acetylene



Being in need of a portable supply of welding gas for the firing line, one pipe line contractor mounted a large-sized acetylene generator on a two-wheeled trailer that was constructed from the front wheel and axle assembly of a dismantled automobile.

An eye bolt, with the eye pointing upward, was attached to each side of the trailer frame, directly above the axle. Into each of these bolts the end of a turnbuckle was hooked. The other ends of the turnbuckles were

KING TYPES 10-LV AND 10-PD SWIVELS

FOR GEOPHYSICAL RIGS AND SHALLOW WATER WELL RIGS

10-LV Swivel
Patent Pending

Be Sure IT'S A KING *Be Safe*

King Types 10-LV and 10-PD are a departure in construction from most swivels and will impress you with their simplicity.

These swivels have no stuffing boxes, washpipes or packing glands. A moulded rubber seal packs against a hardened wear bushing, making an effective seal that will run many weeks before renewal becomes necessary.

A second seal is placed below the wear bushing, to pack between the bushing and the spindle. This second seal is not subject to wear.

Type 10-LV Swivel has a conventional bail and duplex angular-contact bearings at the top and single angular-contact bearings at the bottom and is for use with small rotary rigs and rigs having a hydraulic feed mechanism.

Type 10-PD Swivel has a combination bail and pull-down yoke, used on rigs equipped with a mechanical pull-down attachment.

The same angular-contact bearings are used in 10-PD as in 10-LV with positions reversed. Duplex angular-contact bearings for 10-PD, are at the bottom and single angular-contact bearings at the top.

The bearings in these swivels provide ample thrust and radial capacities to insure long and satisfactory service. They are provided with a means of adjustment below the housing. A grease nipple in a protected opening, provides a means of lubricating the bearings. A good quality of ball bearing grease should be used.

For additional information of King Oil Tools see your Composite Catalog, Volume I, Pages 1915 to 1922.

All prices F.O.B. Houston, Texas, and subject to change without notice.

Sold through your supply store

Export: **R. S. STOKVIS & SONS, Inc., 17 Battery Place, New York 4, N. Y.**

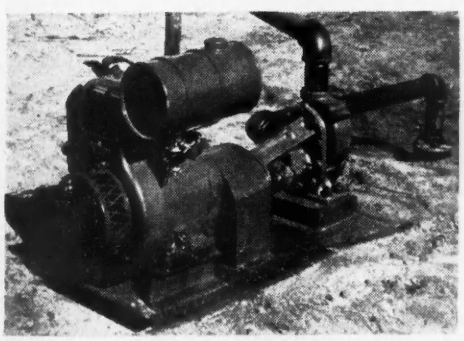
10-PD Swivel
Patent Pending

KING OIL TOOLS

210 TERMINAL STREET **PHONE W. 6-8013**

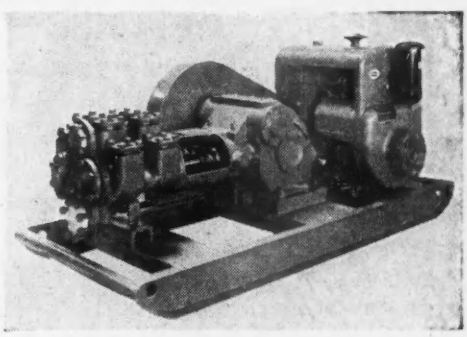
HOUSTON 10, TEXAS

WISCONSIN *Air-Cooled* Heavy Duty Engines



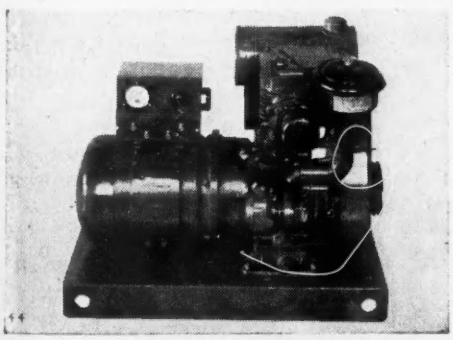
. . . FOR HANDLING OIL, GASOLINE or WATER from LOW PRESSURE to 1,000 Pounds.

•

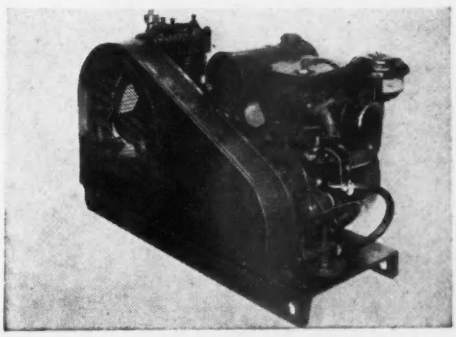


Compressor units for engine starting, paint spraying and specialized uses. Electric lighting plants A.C. or D.C. from 1 K.W. to 5 K.W.

•



Power Range
2 H.P. to 30 H.P.



HARLEY SALES COMPANY

Oil Industry Distributor

TULSA **HOUSTON**

hooked over the lifting handles that are attached to the side of the generator shell, thus affording a means for cinching the generator to the trailer floor.

A square frame made from pieces of 1¼-inch pipe, and supported on legs made from pieces of flat steel stock, ½-inch thick and two inches wide was built around the generator at a height of 20 inches above the trailer floor, to aid in keeping the generator in its right position.

Two racks, one on either side of the acetylene generator, were devised for holding oxygen bottles in a horizontal position. The circular end of each bottle rack was made by cutting a 6-inch length from the end of a piece of 10-inch pipe. These were welded to the front corners of the generator centering frame. A hole was drilled in the top of each bottle ring and a ⅝-inch nut was welded over each hole with the hole in the nut aligned with the hole in the ring. To the top of the bolt, a piece of ⅝-inch round steel stock was welded to form a set-screw with a Tee handle. A ⅝-inch nut run well up on the threads of each set screw serves the purpose of a lock nut.

The other end of the bottle racks were ends of flat supporting legs bent to form a saddle. A slot was cut in the outer end of each saddle, for accommodating a bolt and nut attached to the end of a short piece of chain. The other end of the chain is fastened to the frame.

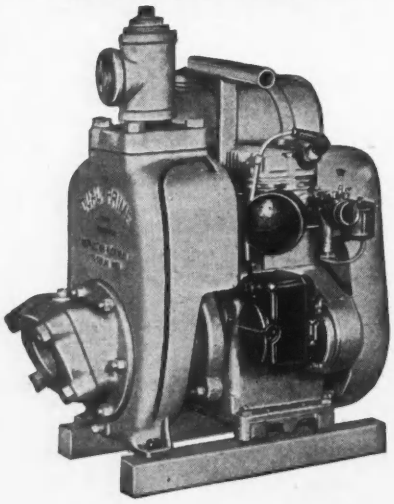
Two adjustable feet—one at the front and one at the back of the trailer—were devised to be used as a preventative against tipping the trailer too far either way. These adjustable feet were made from pieces of 1¼-inch pipe with a piece of flat steel welded at the bottom end. Each leg slips up and down through a short sleeve of 1½-inch pipe welded to the trailer frame. Each sleeve is provided with a set screw made from a bolt and nut, for clamping the leg of the foot in any desired position.

Such a portable supply of welding gas has been found to save considerable time and expense, since the acetylene is generated on the spot.

CMC PUMPS

Handy—Portable—Large Capacity
LIGHT WEIGHT CENTRIFUGALS

Pump illustrated, Model 8A, weighs only 115 pounds. Capacity to 8,000 gallons per hour . . . fast priming. Powered with single cylinder 4 h.p. engine. Compact . . . convenient carrying handle. One of the complete CMC Line of Centrifugals from 1½" to 10" size; also High Pressure and Diaphragm Pumps. Get new Pump Bulletin.

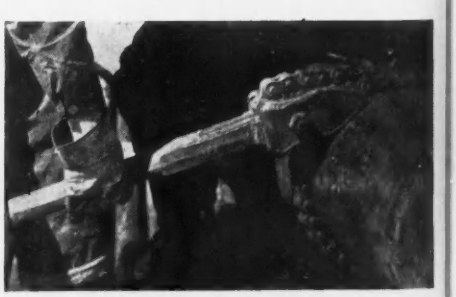


CONSTRUCTION MACHINERY COMPANIES
WATERLOO, IOWA
Oil Field Offices:
1232 E. 18th, Tulsa, Oklahoma • 1903 Blodgett, Houston 4, Texas
Specializing in High Pressure Centrifugals . . . Dual Prime Centrifugals
Diaphragm Pumps for the oil field!

How To—
Speed Pipe Make-Up

To make it easier handling large chain tongs, one contractor cuts off most of the handle immediately after the tongs are purchased. This reduces the weight of the tongs by nearly a half and makes them much easier to handle. Since a large majority of the work with the tongs is in rolling pipe and passing the handle through rather narrow openings, the shortened handle is quite an asset. A short piece of 2½-inch pipe is kept in readiness in case a more difficult job is encountered and more leverage is required.

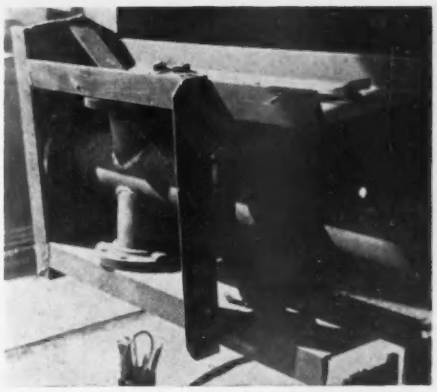
The handle should be cut approximately two feet from the pipe jaws so that a sufficient length of the handle remains to afford enough leverage to roll pipe or make up the starting threads. Where pipe is to be laid across the country, small tongs are used and the handle bent at an angle so the pipe stabber may run the joint up until snug before the large tongs are applied.



How To—

Facilitate Welding and Assembly of Flanged Fittings

A jig which aids in the assembly and welding of numerous similar pipe line fittings is saving considerable time for one company. The welder used three pieces of 12-inch channel iron, welding them together in a box-shape as shown, leaving a space between the two longitudinal members into which can be mounted the fittings to be welded together. Holes burned through the channels are used in bolting the flange fittings in correct position. A rod having threads on both ends is looped around the pipe in the approximate center of the jig, the two ends coming out to be bolted through holes in a vertically mounted piece of angle iron on the side of the unit. Lateral shifting is prevented with this loop.

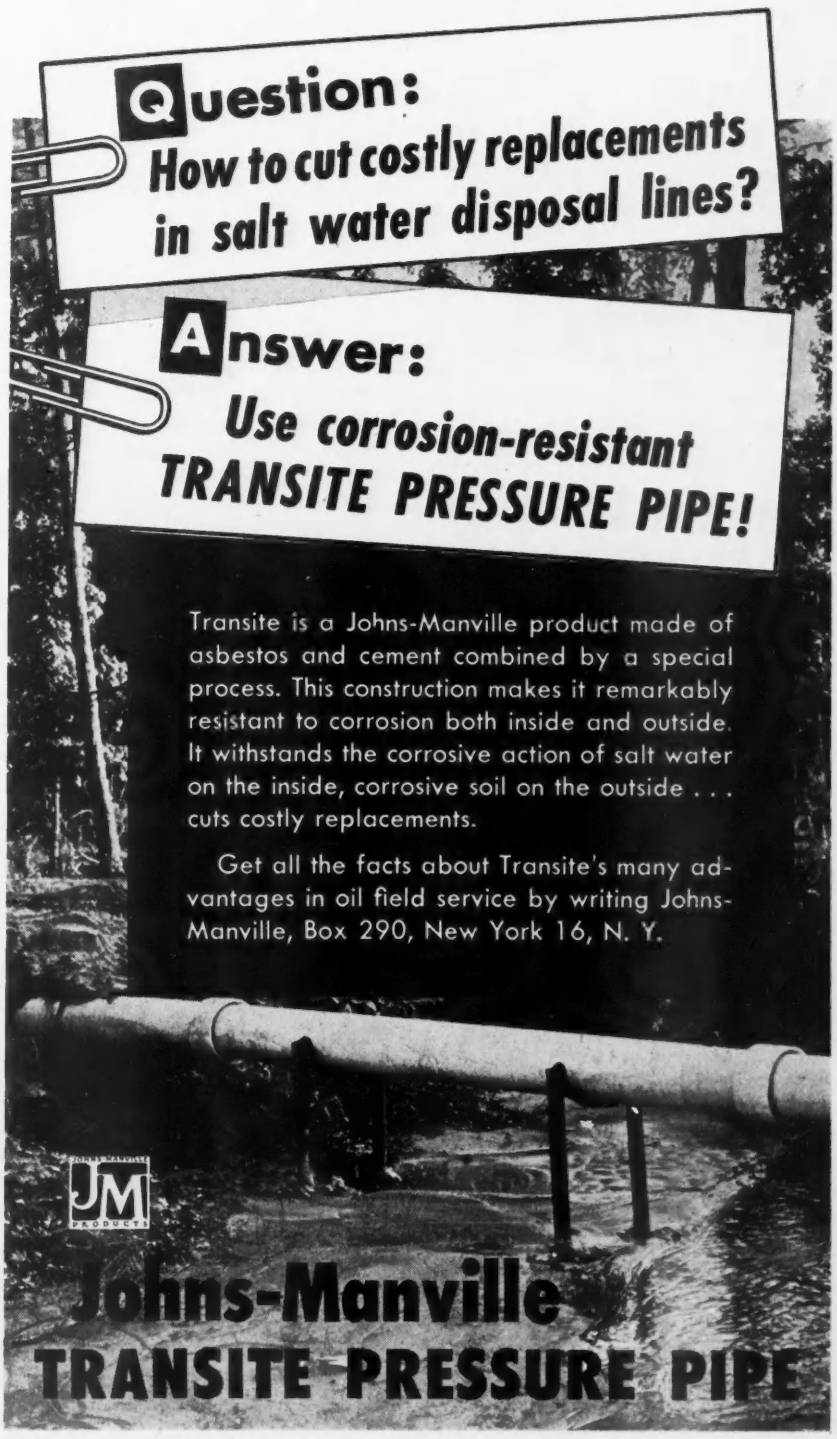


How To—

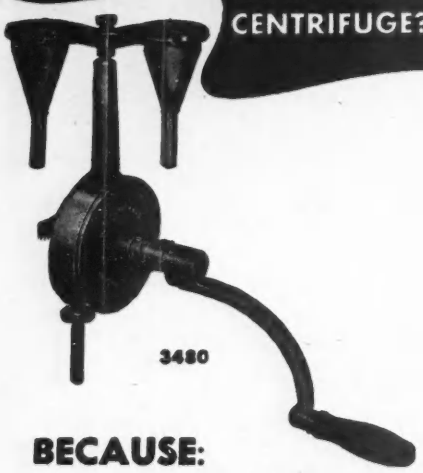
Stop Valve Vibration

Heavy valves which are placed above a high-pressure gas line act similar to an inverted pendulum when the line vibrates. This swinging motion puts heavy strains on the weld between line pipe and riser. Even when the line is one-half inch thick, fractures occur from continued oscillation of the valve.

One gas transmission company welds two six-inch braces to the riser, just below the weld for the flange fitting. These two arms are set at 45 degrees to the riser, and are capped at the lower ends with disks of steel plate. After the line is placed, with a concrete base just below the valve, the two braces are boxed in and concrete poured around them. The concrete anchors the supports and holds the riser rigid. The blocks cast around the braces rest on the pipe supporting concrete base, but art not part of it. This permits the brace to be moved without disturbing the main line. The braces are given the same primer and enamel coating as the pipe.


Question:
How to cut costly replacements in salt water disposal lines?
Answer:
Use corrosion-resistant TRANSITE PRESSURE PIPE!
Transite is a Johns-Manville product made of asbestos and cement combined by a special process. This construction makes it remarkably resistant to corrosion both inside and outside. It withstands the corrosive action of salt water on the inside, corrosive soil on the outside . . . cuts costly replacements.
Get all the facts about Transite's many advantages in oil field service by writing Johns-Manville, Box 290, New York 16, N. Y.
JM
PRODUCT
Johns-Manville
TRANSITE PRESSURE PIPE

Why THE INDUSTRY'S LEADING CENTRIFUGE?



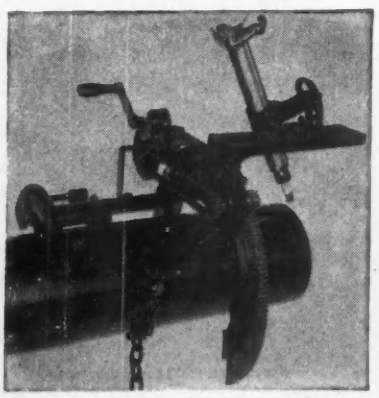
BECAUSE:

Heavy duty, ruggedly constructed and extremely simple in design . . . Gets quick, accurate results . . . produces required speed with less effort . . . Cranks and heads of 100 CC and 15 CC size machines interchangeable . . . Meets *A.S.T.M. Standard Method D-96 and A.P.I. Code No. 25* requirements.

W·H·CURTIN & CO.
DEP'T "C" Inc.
HOUSTON, TEXAS . . . NEW ORLEANS, LA.

for **PIPE CUTTING** *and* **BEVELING** *look to*

H & M



SPEED: Complete Cut and Bevel in 12" pipe only two minutes.
ECONOMY: One-half the labor and gas required of other methods are but two of the savings.
PORTABLE: Easily carried from one section of pipe to another.
ADAPTABLE: Machines for cutting any size pipe.
DURABLE: Long wearing materials gives machine longer life.

Write for Literature

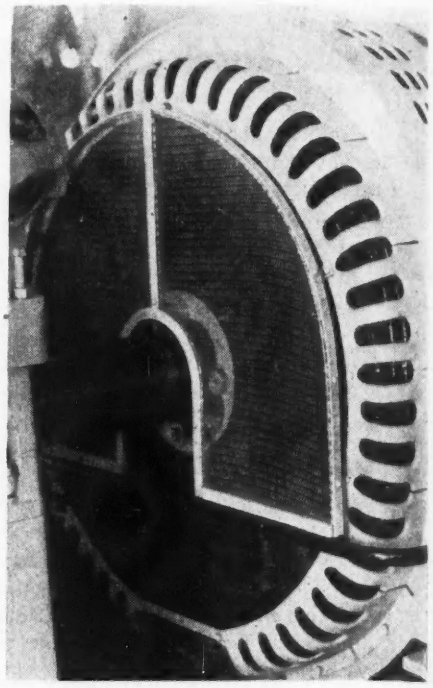
The H & M
Pipe Beveling Machine Co.
611 Petroleum Building, Tulsa, Oklahoma

PIPE LINE HINTS

How To—Guard Open Ends of Large Generator

The open ends of large generators at the compressor station bring about a hazardous situation when these generators are centrally located in the station where personnel continually pass. To preclude the possibility of tools being accidentally dropped in the generator, causing untold damage, and to eliminate the hazard of personnel falling or stumbling into the whirling armature, one station superintendent had a guard made up in the station shops and installed on both the open ends of the generator housing. The guards are so constructed as to permit maintenance men to inspect or repair the generator by merely removing three bolts and removing the guards.

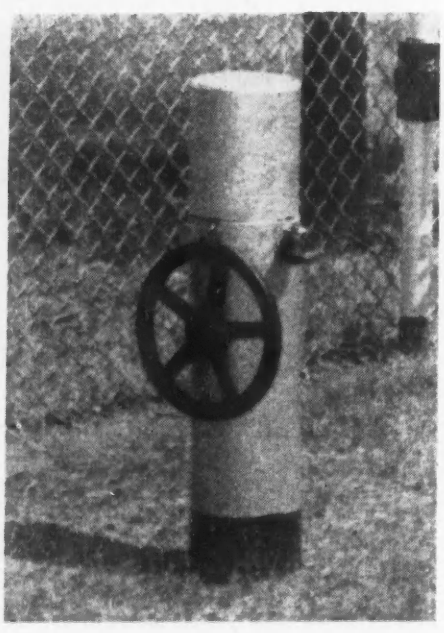
Framework for the guard is made from strap steel formed in such a shape as to adequately cover the opening. A slot made in the guard accepts the generator shaft. Expanded metal is cut to fit this framework and can be either clamped on with small bolts or can be tackwelded to the strap steel.



How To—Prevent Molestation of Gas Line Valves

Pipe lines furnishing communities with gas cannot be maliciously interrupted by some unconcerned person molesting valves in these supply lines. Even though a steel wire fence had been constructed around its metering station, one pipe line company provided additional precautions to insure against unauthorized tampering with the main gas line valves.

The added precaution consisted of enclosing and providing a means of locking the valve stem enclosure. With the main line one or two feet below the surface, at which depth the valve is also located, it was necessary to add an extension to the valve stem by welding an additional piece to the stem. This added section extended about 18 inches above ground level. Around this stem and extending down to the valve is a section of six-inch casing, the upper lip of which was set slightly below the top of the valve stem extension.



PARAMOUNT SUPPLY COMPANY

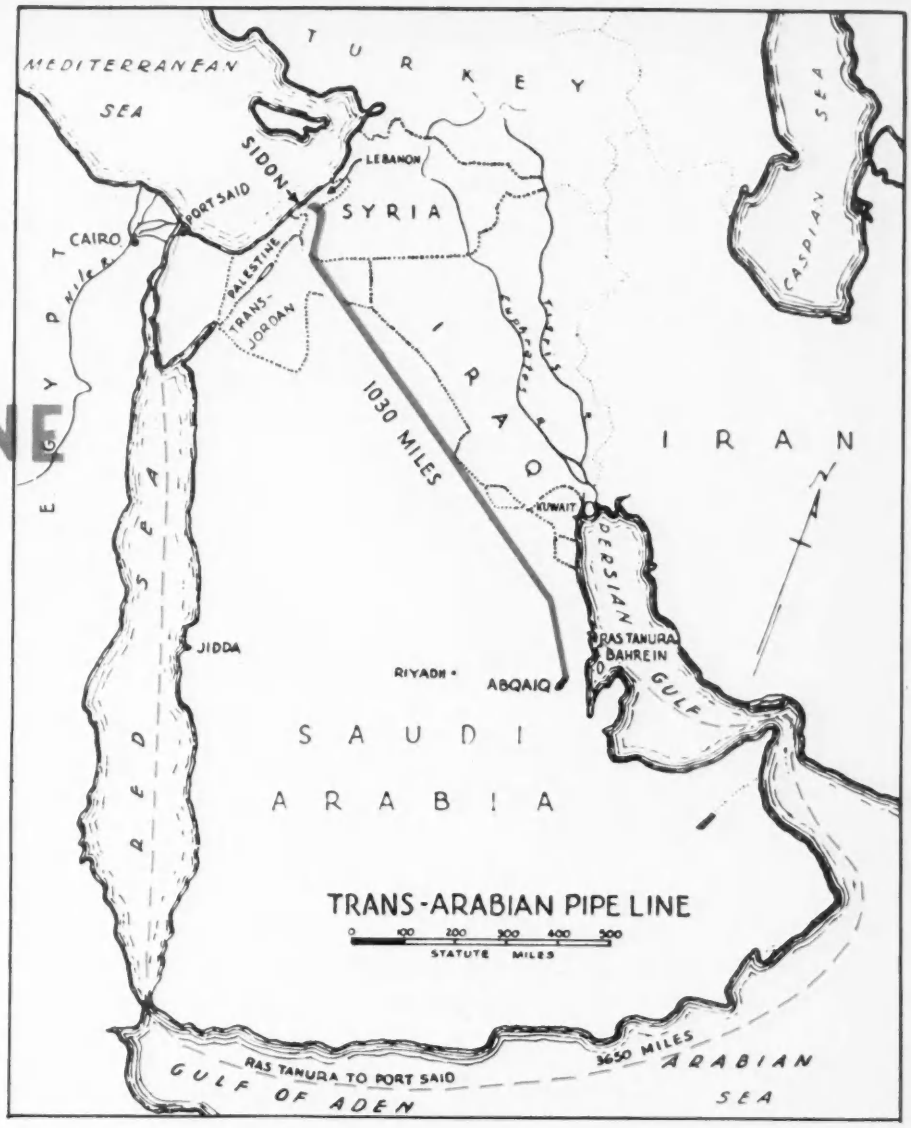
PIPE LINE MATERIAL IN AMARILLO

- Bristol Recording Thermometers
- Buffalo Niagara Water Meters
- Cleveland Pneumatic Tools
- Crosby Gages and Relief Valves
- H & M Pipe Beveling Machines
- Hercules Dynamite
- Johns-Manville Packing
- Lincoln Shield Arc Welders and Electrodes
- Meriam Manometers
- Metric Needle Valves
- Reliance Gas Regulators
- Schramm Air Compressors
- Smith Gasoline Meters
- Tipton Line Up Clamps
- Tnemec
  Industrial Coatings
  Super-Tnemecol Pipe Line Coating
- Victor Acetylene Welding Equipment
- Welderz Frend Acetylene Generators

101 Taylor **Phone 2-1433**
AMARILLO, TEXAS

TAP LINE

By HENRY OZANNE
Staff Writer



Route the new Trans-Arabian Pipe Line will follow, terminating at Sidon, near Beirut, Lebanon, on the Mediterranean coast. It will start at the Abqaiq field in Saudi Arabia and extend in a northwesterly direction and continue in Saudi Arabia near the Iraq border until it crosses into Trans-Jordan and Syria and then into Lebanon. The new line is scheduled for completion in 1949.

TRANSARABIAN Pipe Line Company plans to begin construction in January on its 1030-mile line from the Abqaiq field in Saudi Arabia to the Eastern Mediterranean terminal at Sidon, Lebanon; and the new line may be one of four major transportation factors repatterning the world's petroleum distribution system.

The Consolidated Steel Company plant in Los Angeles is scheduled to begin rolling the 30-inch and 31-inch pipe in October and first deliveries are due before the end of the year. The pipe will be shipped to both Mediterranean and Persian Gulf points so work on the lines can proceed at both ends simultaneously.

The line will have an initial capacity of 300,000 barrels daily with six pump stations and will be completed in late 1949 or early 1950. Later installation of additional pump stations are expected to give the line a throughput of 500,000 barrels per day.

For the job the company has borrowed $125 million at 2.55 percent interest, the loan being guaranteed as follows: Standard Oil Company of California, 30 percent; The Texas Company, 30; Standard Oil Company (N. J.), 30; Socony-Vacuum Oil Company, 10. These figures also represent the ratio of ownership of Arabian American Oil Company (Aramco), parent corporation of Trans-Arabian Pipe Line Company (TAPline).

The line will traverse rugged country for virtually its entire distance and is one of the biggest projects ever undertaken by private enterprise. It still is undecided whether to bury the pipe or lay it on the surface of the great Nejd desert across which it will run. In the opinion of some experts, a ground line would hug the desert surface close enough to be rigid and secure. Other authorities think the pipe should be laid in the conventional ditch to prevent sand shifting out from under it and leaving it hanging in the air.

The Abqaiq field where the line will start is the largest in Saudi Arabia now and has 19 producing wells, with five additional wells being drilled. Present Saudi Arabia production is at the rate of 263,000 barrels a day and may top 300,000 this year. By 1949 a production rate of more than 600,000 barrels daily is in sight. Most of the present production is processed at Aramco's refinery (110,000 barrels a day) at Ras Tanura, and at the Bahrein Petroleum Company's refinery (135,000 barrels a day) on Bahrein Island, from where the product is shipped by tanker. Bahrein Pe-

troleum Company is a wholly-owned affiliate of California Standard and The Texas Company.

Pipe Problem

Now that transit rights have been signed for the line with Syria, after an impasse of many months, TAPline's only foreseeable delay in beginning construction would be difficulty in exporting the pipe. The Independent Petroleum Association of America, through its general counsel, Russell Brown, has protested an export license for the delivery of the 240,000 tons of steel required for the pipe. Specifically, IPAA asks the Office of International Trade of the Commerce Department to reject application by Aramco for the export license to send 40,000 tons of pipe to Saudi Arabia during the fourth quarter of 1947. Aramco would export a like amount of pipe through each quarter of 1948 and the first quarter of 1949.

In a letter to Averell Harriman, Secretary of Commerce, and to the chairman of nine Congressional committees, Brown opposes export of the pipe because of domestic pipe scarcity and on the ground that any petroleum shortage this winter "will be due to lack of steel pipe for construction of oil and gas pipe lines necessary for transporting the needed fuel to consuming areas."

Aramco points out that crude now moves by tanker from the Persian Gulf to European refineries. This tanker haul around the Arabian peninsula and through the Suez Canal to the Mediterranean is approximately 3650 miles. The pipe line will cut 2620 miles from this expensive marine route. J. H. MacGaregill, TAPline vice president, adds that the pipe line "will make available 300,000 barrels of oil daily to Europe, thereby relieving the unprecedented demands on the United States petroleum sources."

The implications in this vast new distribution pattern are great:

1. American operators may displace British interests as dominant suppliers from the Middle East. The British still are the major producers in Iraq and Iran, but Middle East oil operations are shifting more toward American interests. This is underscored in the announced plans of Standard and Socony-Vacuum to purchase crude from Britain's Anglo-Iranian Oil Company over a 20-year period, in addition to enlarged output from American holdings in Saudi Arabia.

2. A huge new supply of world oil is in prospect of arising in the Middle East, the very volume of which will profoundly alter world marketing patterns. Of especial significance are the now-projected oil deliveries to the Eastern Mediterranean centering around the four great pipe line ventures:

A. TAPline's 300,000 barrels daily to Sidon by 1950.

B. The new 16-inch Iraq Petroleum Company line from the Kirkuk fields to Haifa, Palestine, and Tripoli, Lebanon, a system which in conjunction with the existing 12-inch line would add up to 300,000 barrels a day.

C. The projected Anglo-Iranian line by Middle East Pipe Lines, Ltd., from the Iran fields at the head of the Persian Gulf to some eastern Mediterrean port, with a capacity of at least 300,000 barrels a day intially, and perhaps 500,000 eventually. Plans now call for 31- and 32-inch pipe, or even perhaps 34- and 36-inch. The whole Anglo-Iranian line, in which Jersey Standard is to have a 40 percent interest, and Socony-Vacuum a 10 percent interest, will be held up until after TAPline's Abqaiq-Sidon system is completed, because of the bottleneck in rolling large-diameter pipe.

D. The increasingly discussed third IPC pipe line direct from Kirkuk to Tripoli; another 30-inch system with another 300,000 to 500,000 barrels a day ultimate capacity.

All this gives a possible 1,200,000 to 1,800,000 barrels a day total delivery from the Middle East probably in about ten years, as compared with 700,000 barrels daily in 1946. Such a gigantic flow of oil from the Middle East would cause numerous changes in the world's movement of petroleum.

Demand Picture

Against the background of such a Middle East production and transportation system two facts in world requirements for petroleum products are emerging:

1. U. S. total domestic demand will be far greater in the next 20 years than has been predicted hitherto. A 1965 requirement figure of close to 7 million barrels daily has been forecast by government investigators.

2. World demand outside the U. S. will increase sharply, especially in Europe. Standard Oil Company of New Jersey has estimated world demand will be 10 million barrels daily by 1951, a 35 percent increase over 1945. European demand, according to Standard Oil Company of New Jersey, will be 63 percent greater in 1951 than in 1946. This would mean a demand of 1,300,000 barrels daily, a gain of 500,000 barrels. Marshall Plan conference figures on petroleum requirements, figures which are not yet consolidated into any final balance sheet, show that all Central Europe is programming rapid conversion to oil because of the uncertainty of Ruhr coal production. To a lesser extent North Africa and Asia are preparing to take increased quantities of oil; it is even suggested that the Far East refineries may shortly be charged with Middle East crude.

Since the Middle East is economically the logical source for European requirements, roughly 1 million barrels of oil a day may flow from there to European markets in the next few years. It was in anticipation of such picture as this that California Standard sought a half interest in Texaco's marketing outlets in Europe and North Africa, and that Jersey Standard and Socony-Vacuum bought into Middle East production. Transfer of Europe's oil source to the Middle East would free most of South America's production for U. S. importation. This even at present production rates could mean 1 million barrels daily from Latin America seeking a market in the U. S., or double present import rates. However, unless U. S. crude production increases much faster than generally anticipated, this additional oil may not prove excessive. South American production, of course, is to be stepped up in coming years, but growing consumption may be able to absorb it if the rate of increase is not too rapid.

Then, Middle East crude also could be shipped direct to America's East Coast refineries. Middle East oil can be delivered on the Atlantic seaboard, after the pipe line is in operation, at about $1.25 a barrel.

Total 1938 demand for oil in Europe and Africa was only about 1 million barrels a day, of which more than one-fourth was supplied from within those continents themselves. Of the 765,000 barrels daily imported into Europe and Africa, 235,000 came from the U. S., and 340,000 from South America and the Caribbean. The rest represented Middle East contribution.

A completely new prospect is ahead when Middle East sources supply the major part of the requirements of three continents. At that time the Western Hemisphere may well be on the way to becoming an "oil-sufficient" region of the world, the bulk of South America exports coming into the U. S. Such a development would be in line with the main policy principles laid down at the Paris conference on the Marshall Plan and at the Rio conference for inter-America defense.

Casing Run at Papua

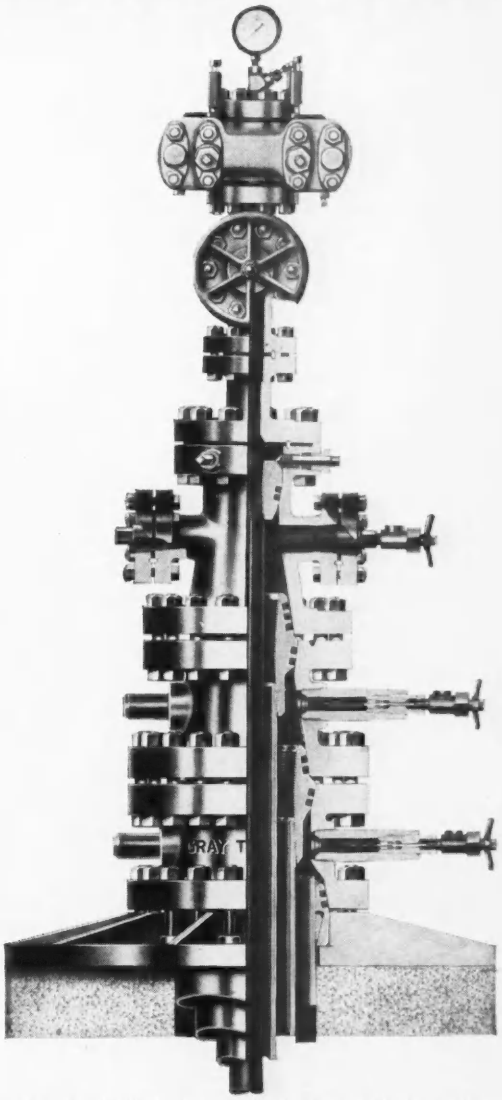
At the important Kariava test well in Papua being sunk by a group of international oil companies in conjunction with Australian interests underreaming was stopped at 8488 feet on August 2 and 6⅝-inch casing run to 7864 feet. The hole has now been cleaned to 8538 feet.

PLANS AND SPECIFICATIONS

Permit concentrating on control rather than on selling equipment

Simplicity, meaning the fewest number of highest quality parts, can become a reality only through coordination. No miscellaneous group of individually strong parts can possibly approach the operating efficiency, economy and strength of equipment that is designed from the start to work as a unitary whole. The manufacturer who actually succeeds in finding a solution to the problem of well control must concentrate on the development of control, rather than on the sale of equipment. The better design accomplishes its purpose with fewer, rather than more parts. The advantages of Gray Systems of Well Control will not be fund in weighing equipment. They exist in the fact that, in building a system of well control, Gray eliminates from the permanent structure many parts which heretofore have remained as a permanent source of trouble after they have completed their full operating function.

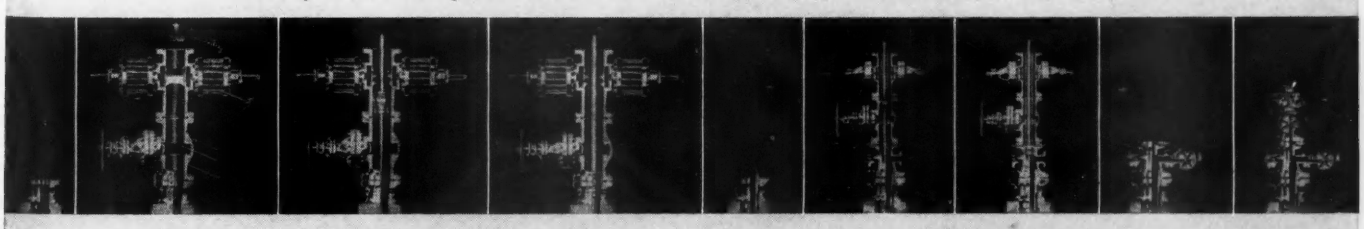
Gray Systems of Well Control are completely planned and coordinated methods of operation. These systems are on the job around the world, shouldering the problems of men who have to work in well control. Knowledge gained from problems solved with men who actually drill oil wells is available to you when you use Gray Systems of Well Control.



Complete Well Head Assembly Equipped with Composite Manifold, Valve Removal, Installation and Renewal.

GRAY TOOL COMPANY
HOUSTON

Export Representative: GUY E. DANIELS, 30 Rockefeller Plaza, New York City
Rocky Mountain Representative: CARL MOULDEN, P. O. Box 1890, Casper, Wyoming



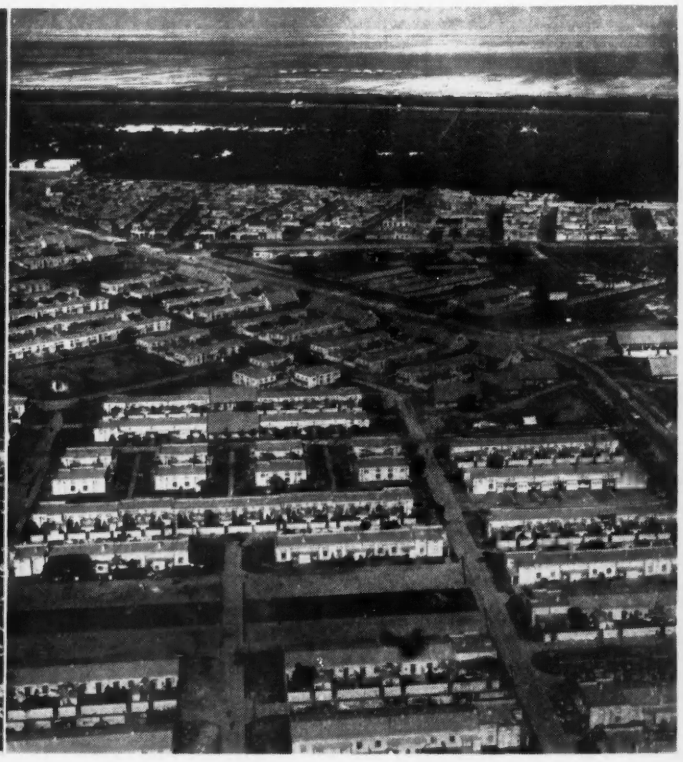
Casing Head Attached | Drilling | Running Casing | Casing Landed | Drilling Control Equipment Removed | Drilling-in and Running Tubing | Tubing Landed | Control Equipment Removed | Manifold Attached

PICTORIAL VISIT TO *Iran*

IRAN, currently the largest oil producing area in the Middle East, produced nearly 145 million barrels of oil during 1946 as compared with 127½ million in 1945 and only 50 million in 1941. All producing fields are located on Anglo-Iranian Oil Company's concession of approximately 64 million acres in the southwestern portion of the country, near the head of the Persian Gulf.

Photographs on this and following pages show some of the facilities of Anglo-Iranian Oil Company.

Air view of Anglo-Iranian Oil Company's famous refinery at Abadan, Southwestern Iran, the largest in the world with a daily charging capacity of 400,000 barrels.



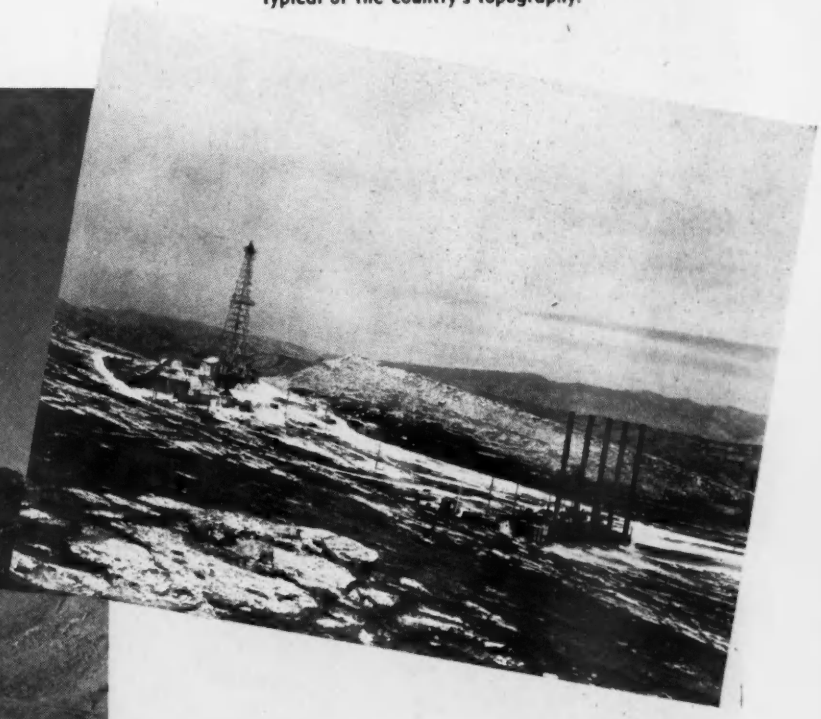
At left is a general view of Abadan. In the foreground is one of Anglo-Iranian's housing estates, with the old town immediately above the refinery in the background. At right is a closer view of one of the company's housing estates for employes.

Right: Main pipe lines from Agha Jari oil field. Field is in the background.

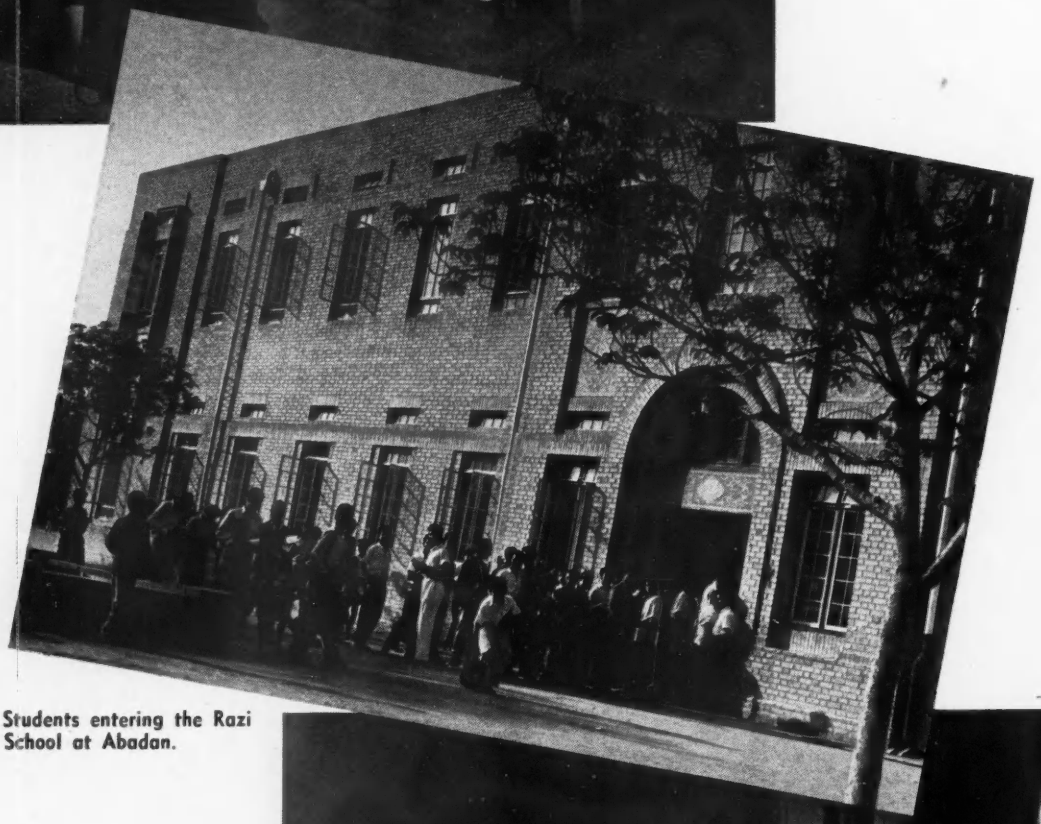
Above: Small distillation unit in the Agha Jari field, used to meet local needs.

Below: A well in the Lali field, north most production in Iran, and typical of the country's topography.

Left: Automatic flow-limit valve on a high pressure production line.



A part of the X-ray department in the Anglo-Iranian Oil Company's hospital at Abadan.



Above: Students entering the Razi School at Abadan.

Right: Reading room in the modern Technical Institute, built and equipped by Anglo-Iranian Oil Company at Abadan.

Wherever your operations may be—even on a remote jungle wildcat location in Borneo or Colombia—

SCHLUMBERGER

is prepared to bring you the same dependable well services that have distinguished Schlumberger operations in the United States, and adapt them to your specific problems and operating conditions. This world-wide service organization is closely knit and is constantly exchanging operating ideas on:

ELECTRICAL WELL LOGGING • GAMMA RAY LOGGING • PRECISION GUN PERFORATING • RADIO-ACTIVE DEPTH MARKERS • SIDE WALL SAMPLING PHOTOCLINOMETER SURVEYS • DIPMETER SURVEYS • OPEN HOLE CALIPER SURVEYS TEMPERATURE SURVEYS • WATER FLOW LOCATION

SCHLUMBERGER SURENCO

Caracas, Venezuela
Apartado 1608
Cable: Surenco
Serving: Venezuela, Trinidad, Ecuador, Brazil and Mexico

SCHLUMBERGER OF LATIN AMERICA

Caracas, Venezuela
Apartado 1608
Cable: Schlumberger
Serving: Colombia and Peru

CIA. DE INVESTIGACIONES GEOFISICAS SCHLUMBERGER

832 Avenida R. S. Pena
Buenos Aires, Argentina
Cable: Schlumberger Buenos Aires
Serving: Argentina and Chile

SCHLUMBERGER OVERSEAS

P. O. Box 25
San Fernando, Trinidad
Cable: Schlumberger San Fernando
Serving: Egypt, Persian Gulf, British India, British Borneo and Netherland East Indies

SOCIETE DE PROSPECTION ELECTRIQUE

42 Rue Saint Dominique
Paris 7, France
Cable: Proselec Paris
Serving: Europe and French Union

STATE DEPARTMENT GIVES A HAND

U. S. Independents and Foreign Oil

By HENRY OZANNE

THE VENTURE of a group of U. S. independents into the Middle East is an event that has a diplomatic singificance to match its importance to the oil industry. Not only does it represent the initial project of U. S. independents in foreign fields; it also reflects the newly-emerged policy of the U. S. State Department to aid and protect American oil interests abroad. In this revealing question-and-answer interview with a State Department official, a *World Oil* staff writer gives a clear definition of this new policy.

ORGANIZATION of the American Independent Oil Company and its projected program in the Middle East are the first reflection of the U. S. State Department's emerging policy for diplomatic protection of and assistance to American oil interests abroad. This policy was sketched to the writer by a high spokesman of the State Department and covers the following principles:

It long has been the wish of the Department to see a broader base for U. S. oil operations abroad. Some concern especially has been felt over the fact that only five American companies—including the country's largest "majors"—dominate the oil picture in the Middle East, expected source eventually of perhaps as much as 40 percent of the oil we shall use in this country.

Dangers in Situation

Two concrete dangers are concealed in such a situation, the Department representative points out:

1. Heavy petroleum imports into this country may be difficult as long as concessions and foreign production are exclusively in the hands of the big companies. Oil imports are becoming an increasingly significant factor in our national economy, and the current year will be the first in our history that the U. S. becomes a net importer rather than a net exporter of oil.

The Truman administration, of course, is fairly committed to its own official findings that by 1965 the U. S. will be importing half of its oil requirements. Resistance to such large-scale importation is more likely on the part of both the producing country and the American public as long as America's foreign oil can be regarded as the special and privileged property of the big companies. The suggestion has been advanced that neither foreign governments nor the American people like to consider themselves as playing into the hands of gigantic private business firms, and that the Department believes that the entry of more and smaller American oil companies into foreign oil operations will reduce the psychological barriers against stepped-up oil importation.

2. The State Department, according to this spokesman, feels that a wider spread of American ownership in oil interests abroad will contribute to the stability of concessions and producing programs. It is recalled that in the past that expropriation actions, wherever they have taken place, have been justified under the "octopus theory"—that the American companies were huge monopolies exploiting solely for their own benefit the natural resources of the countries in which they operated. The larger the size of the units involved, the more impersonal seems the interests of the nationals concerned.

There is a corollary to this second point: Full diplomatic protection may be more easily and properly extended, in the viewpoint of the average American citizen, when widespread national interests are at stake. "Otherwise it looks like the government is working for one oil company."

Several months before the creation of American Independent Oil Company, the State Department made representations to a number of "smaller major and independent" oil companies, allowing its own thinking to become generally known and offering Department assistance to any company wishing to enter the foreign field. The Department spokesman insists, however, that at no time did the State Department urge the association of any companies for foreign activity, nor in any way instigate the formation of the American Independent. It did, though, offer such assistance as advising as to what concession areas are still open and exploring with company representatives many of the peculiar technical and political difficulties linked with foreign operations.

Principles of Policy

Some of the broad policy principles evolving in State Department programming now, as disclosed by the Department official, are covered in the following question and answer report:

Q—In connection with whatever policy of diplomatic support the State Department plans to lend American oil interests abroad, to what extent does the Department intend to rely on industry itself; that is, how much industry-Government collaboration can be expected?

A—A very thoroughgoing cooperation exists now and has existed between the Department and the industry. It is more informal, however, than formal; and we are not making use of structured industry-government panels. Rather than such formally constituted boards, we prefer to consult the industry on notice and anywhere for factual information on which we must rely. We believe it is a better plan to be able to take down the phone at any hour and talk with industry experts any place in the country. We do this, and we feel we have now and will continue to enjoy the full confidence of the industry and will benefit fully by its technical and expert advice.

Q—Does the Department expect that discussions on oil will be carried on at the inter-governmental level with any or all of the nations involved?

A—Yes, certainly, by the very nature of things; but so far no conversations have been on this level except the Anglo-American treaty. We are not sure just yet of future action along this line, and that may have to be clarified by White House direction. A good case in point of the need for such top-level conferences is that of Brazil. It now appears urgent that not only State Department, but Commerce Department and War and Navy representatives as well take part in the effort to reach some understanding with Brazil on the matter of her petroleum policy. (The spokesman

denied that any inter-government parleys had yet occurred between the U. S. and Mexico, despite published reports that such conversations had been held both in Washington and in Mexico City. "Nothing to the story," the Department representative commented.)

Q—In connection with any policy for the diplomatic support of the foreign oil operations of American companies, does the Department see any need for restrictions on the principle of free, private enterprise, especially since in some cases American oil operators will be dealing with the state-controlled enterprises of other nations?

A—In general, the answer is "no." That is, the Department sees no need for any impairment of the substantive content of the principle of free, private enterprise. However, American oil operators abroad may have to revise their thinking on the form of certain arrangements. It may no longer be possible to operate abroad as it has been in the past. For instance, the type of arrangement reached by Union Oil Company with Paraguay may indicate the new form of operating arrangement—in this case Union possesses no "rights" at all to the oil, but will receive a part of whatever oil is produced as an "allowance fee" from Paraguay. This preserves the form of state sovereignty for Paraguay and state ownership of subsoil deposits, but actually allows the American operator just about what he's after, anyway. It seems also most sure that American oil capital again will be invited into Mexico, and when it is, something like this may be the pattern of the arrangement.

Q—Does the Department see any cartel aspect in the present or projected foreign oil picture?

A—No. But that doesn't mean that the issue may not be raised. In a way it already has been raised by the international petroleum cooperative in its plea to the United Nations to concern itself with Middle East oil. Remember the McPherson, Kansas, refinery instance and other cases. Whether or not American Independent Oil Company restricts the sale of oil to its own members conceivably might be a monopoly question. The answer does not appear clear as yet.

Soviet Pipe Mills Restored

Restoration of all the pipe-rolling plants destroyed in the U.S.S.R. during the German occupation is scheduled for completion in 1948 and by 1950 Soviet pipe mills will produce 22,000 miles of pipe annually, much of which will go to the oil industry. Meantime, imports from Czechoslovakia will help to bridge the gap.

American Independent Operating Plans Vague

TWO months following the announcement of the formation of American Independent Oil Company, a $100 million corporation to engage in foreign petroleum operations, concrete details about the company's program are still lacking. Questions put to officers of the new organization have failed to elicit additional information. Ralph K. Davies, president of AIOC, stated to WORLD OIL: "As of this date, American Independent has formulated no definite plans beyond the general plans announced."

Among questions on which there is much speculation are the following:

1. Where does AIOC plan to operate?

So far the company's statement refers only to the Middle East, but it is known that some of the company's officers have mentioned the possibility of other areas, specifically Mexico. In this connection Sam B. Mosher of Signal Oil & Gas Company and himself a vice president of AIOC, has been seen in Mexico lately and is known to have developed a good first-hand working knowledge of conditions there.

Open Areas

As far as the Middle East is concerned, areas now open for possible concession are relatively few and not too choice. They are: (1) the two neutral zones of Kuwait-Saudi Arabia and Kuwait-Iraq; (2) Yemen; (3) surrendered Iraq Petroleum Company leases along the east side of the Red Sea; (4) south Iran outside the concessions of the Anglo-Iranian Oil Company; (5) the Levan states of Lebanon and Palestine; and (6) the western half of Saudi Arabia not included in the concession of Arabian American Oil Company.

With the exception of the neutral zones these areas are not regarded as highly favorable oil territory.

There are two so-called "neutral zones" on the Map of Arabia, the Kuwait-Saudi Arabia zone being to the south of Kuwait and the Iraq-Saudi Arabia zone lying to the west of Kuwait. The historical origin of these zones is in the topography of the land and the tribal customs of its nomadic inhabitants. The areas are thinly populated by roving Bedouin bands who move their sheep and camels hundreds of miles in the course of a season in search for waterholes. The "neutral zones" came to be recognized as such chiefly because of the inability to set up precise boundaries in the shifting sands of the region where there are no landmarks; and secondly, because the Bedouin inhabitants thereof are sometimes the nominal subjects of King Ibn Saud and sometimes those of the sheikh of Kuwait, al Jabir as Subah, depending on migratory movements.

Both of these neutral zones are referred to as "codominions," and represent the undivided authority of the two rulers: Ibn Saudi nad Sheikh al Jabir as Subah in the one case, and Ibn Saud and King Faisal II of Iraq in the other. This is an extremely important political point because it means that whatever oil concessions are granted in the zones will not be on the basis of geographical division. Just what the basis of division will be is not yet clear, but it is expected that it will call for a split of the down payments, annual stipends and royalties between the two sovereigns.

The Kuwait-Saudi Arabia zone is 1800 square miles in size; the Kuwait-Iraq zone is 2600 square miles. The latter zone has not been involved in recent bidding, and under Iraq Petroleum Company's claim is not open for bids. IPC contends that the zone is already covered in the concession grant to its affiliate, Basrah Petroleum Company.

This would leave of the two only the Kuwait-Saudi Arabia zone open, and it is generally conceded that Arabian American holds Ibn Saud's half of that. Whoever obtains the sheikh's half must, presumably, come to terms with Aramco. It is learned that bidding for the Kuwait half of the zone began a couple of years ago with an offer of $400,000 down payment, $300,000 annual payment, and no royalties provided. The bidding has become sharper since April, 1947, and the latest offer is of 600,000 pounds sterling ($2,400,000) down payment; 75,000 pounds yearly ($300,000), with royalty of 5 rupees, 4 annas per ton of oil. The last royalty offer is especially unsatisfactory to companies already in the area as it indicates the possibility of disturbing presently existing royalty arrangements throughout the whole Middle East.

One oil man expressed the effort of independent operators to acquire acreage in the neutral zone in these words: "The position of the independents is similar to

that of a man going out to stake out a quarter section in the Old West years after there has been exploration and a land boom. Such a bidder could hardly hope to get in on groundfloor prices. He might, however, due to unusual reasons be able to pick up a small piece of land which could have a nuisance value to his neighbors. Such things have been known in the American and Canadian West in the early days, but they have no national significance."

Yemen Case

The case of Yemen is utterly different. Yemen is an independent Arab kingdom on the southeast end of the Arabian peninsula, 75,000 square miles in area with a population of about 3½ million. The ruler is the aging Imam Yahya, who in the past has discouraged all Western penetration into the country. A number of technical and cultural missions have visited Yemen in the past, but all except one were turned out with no cooperation from the Imam. The only exception was a French medical mission, significant because two geologists were able to attach themselves to it in 1937 and most of what is known of the kingdom as to its oil potentialities is due to their survey. On the whole their report was unfavorable. They pointed out, among other things, that it is one thing to get a concession in Yemen and another thing "to exercise in any normal way exploration rights." There also are indefinite boundary difficulties which would have to be resolved if any American firms went in the country.

One important petroleum authority in Cairo has made the following statement about the interest now being shown in Yemen by foreign oil companies:

"The rumor in Europe is that U. S. interests, sponsored by the State Department, had secured permission to explore and develop mineral resources in Yemen. It is said to be understood that if any arrangement is made, it will be on something like a 50-50 basis on gross proceeds or in kind."

He added: "There also are questions, due to lack of survey, as to whether certain districts lie under the sovereignty of Yemen or in the Aden Protectorate. The whole situation seems to indicate that whatever rights are granted and to whomever they are granted, there are serious political and practical difficulties to operating in Yemen."

Other companies besides American Independents have bid for the Yemen concession, according to George Wakim, secretary to the Yemen prince on his recent visit to the United States. Wakim said that after all bids were received, Yemen might counter by laying down its own terms on which it would be willing to grant the concession.

Objections could be raised to the other concession areas still open. The eastern Red Sea strips yielded by IPC have been surrendered by the company on advice of its geologists. Iran is politically hazardous, near the Soviet sphere of influence. The Levant states already have been entered and partly explored, and IPC is drilling in both Lebanon and Palestine.

It has been suggested that American Independent might wait on acreage surrender by Aramco in Saudi Arabia. Substantial relinquishments are expected by Aramco, beginning probably about 1951, but since the terms of the Aramco concession have never been published it is not known exacatly what territory and in what areas will be yielded.

Other Questions

Many other questions concerning AIOC projected operations in the Middle East have been raised:

Is the 11-unit composition of AIOC as originally announced final or tentative? It is known that several other companies have been investigating the feasibility of joining the new independent setup, presumably on invitation of the group as now formed. In what ratio is capital to be subscribed?

Then, would oil go to the component members in the form of crude or product? If the former, what will the non-refining members of AIOC do? It is proposed by one authority close to the plan that arrangements be made by which any component company can take its share in oil, but also has the option of selling the crude to other members. But would the company sell to other firms outside AIOC? This question has implication for possible cartel issues that could develop under anti-trust action or otherwise.

If AIOC plans to refine any or all of its oil, where would the refineries be located? George Wakim, secretary of the Yemen delegation to the U. S., told WORLD OIL that Yemen definitely wants a refinery built by the concessionnaire in Yemen.

Does AIOC plan to lay a pipe line from its fields to the Eastern Mediterranean? If so, what are the specifications for such a line? Would the line be a common carrier or simply a company operation?

What ancilliary services does AIOC plan in connection with its program in the Middle East—will it build hospitals, homes, roads, maintain its own communication services, as do the other companies operating there?

Where would oil lifted by AIOC be delivered—to Europe or to the U. S.? If the company actually brought oil into the U. S. for the benefit of the marketing operations of its component companies, where would be the port of entry and what would be the pattern of distribution?

From the statement of Davies and others it is clear that the independents have not yet come to grips with their own problem on the operating level. One competent observer expresses it this way—that until AIOC is prepared to deal with the chief concrete details that constitute an operating program, "the whole plan is not yet a business matter but merely a grand idea."

Poland's Production Gains; Activity Centers in South

Prospecting is being carried out in Poland, particularly in the south in the neighborhood of Zywiec, Mielec and Busk. Several rigs were purchased recently in the U. S. for exploration.

The Polish foundry at Stalowa Wola is concentrating on the production of oil well pumps, which in the past were exclusively imported from abroad, and during the first half of the year, 100 such pumps were delivered to the oil industry.

Polish oil production has shown a marked increase during the first six months of the current year, when 60,831 tons of crude were produced as compared with 55,600 tons for the corresponding period of 1946. Many deposits of natural gas have also been discovered recently.

The main oil fields of prewar Poland around Boryslaw nad Drohobycz now belong to Russia under the terms of the Yalta and Potsdam agreements. However, considerable quantities of oil and gas are imported into Poland from these fields and in addition data now released for the first four months of 1947 reveal that oil imports of 30,530 tons were the largest single item in Poland's imports from Hungary.

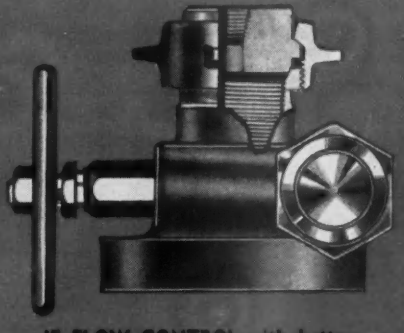
A representative of the French Oil Company "Societe Francaise Industrielle at Commerciale des Petroles" is visiting Poland where discussions are now going on with the government concerning a settlement of the company's Polish possessions.

Shell Depot Damaged

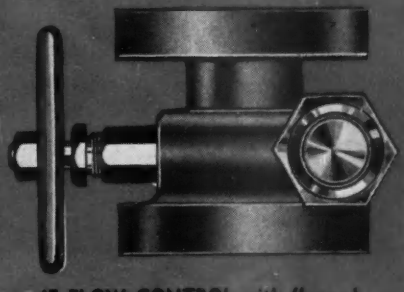
One of the biggest oil fires in Batavia's history took place at the Shell Oil Company's depot at Kampong Kotja near Tandjong Priok, port of Batavia. Sabotage was beleved to be the cause of the blaze, which involved 300,000 drums of petrol and oil. In northern Sumatra, in Republican territory, the oil refinery at Pangkalan Brandan and the oil storage tank belonging to it were set on fire by the Republicans when the Dutch troops were on the point of occupying the installations.

FLOW CONTROL

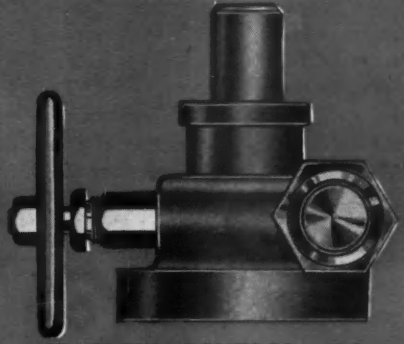
At it's best by Oil Center Tool



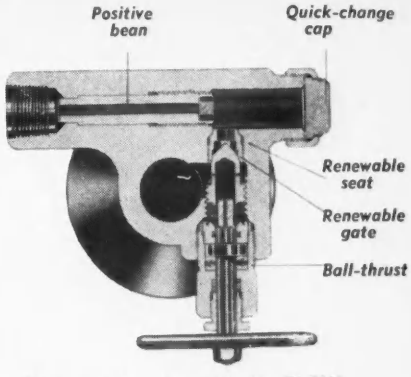
JE FLOW CONTROL with bottom hole test adapter fitting.



JE FLOW CONTROL with flanged top connection.



JE FLOW CONTROL with threaded bull plug connection.



Cross-section view of JE FLOW CONTROL fitted with positive choke.

For oil and gas wells operating under proration, O-C-T has developed the control unit that is unexcelled for compactness, dependable performance, and ease and economy of maintenance . . . the JE FLOW CONTROL.

Note in the accompanying illustrations how its compactness eliminates weight, bulk, and fittings required by the conventional tree wing. In some instances this saving in cost amounts to one-half, not including the saving in transportation costs. Note, also, that the gate, seat, or any other part of the unit may be easily replaced in the field. The choke section may be fitted with either a positive or adjustable choke as desired.

Numerous installations of the JE FLOW CONTROL have proved conclusively its ease of operation, which is due to its balanced pressure type wing valve with floating gate.

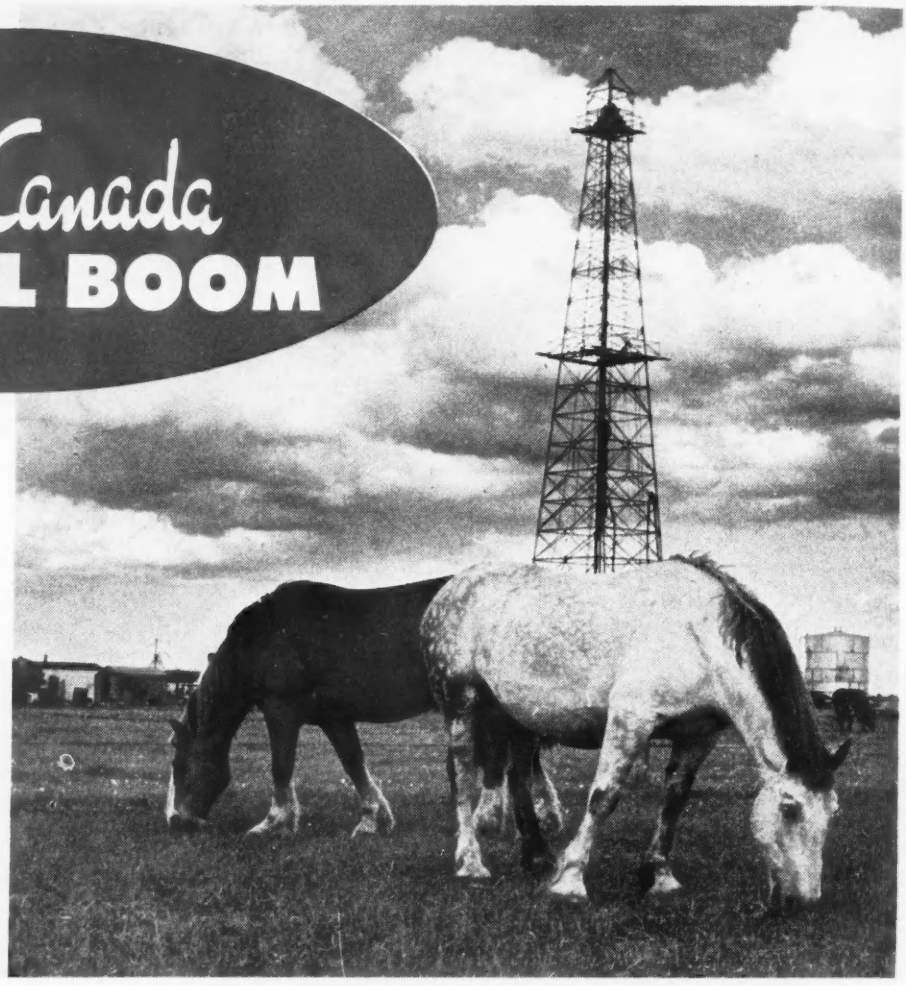
Full particulars on the JE FLOW CONTROL will be sent on request, or an O-C-T sales representative will gladly call to discuss your particular flow control needs.

OIL CENTER TOOL COMPANY

P. O. BOX 3091, HOUSTON, TEXAS

Export Representative: Val R. Wittich, 30 Rockefeller Plaza, New York, N. Y. *Sales Representatives: Houston*—Jack Edwards, Walter Burke, O. F. Jolly, John H. Moran. *Midland:* R. E. Galloup. *Alice:* C. J. Hillman. *Lafayette:* W. C. Fatjo, L. E. Moss. *Shreveport:* H. C. Stewart. *Oklahoma City:* I. C. Wells. *Corpus Christi:* M. C. "Mike" Hunter, Notetaker R. W. (Ace) Elliott.

Western Canada OIL BOOM



By C. O. NICKLE
Staff Writer

WESTERN Canada is in the midst of an oil boom, probably the greatest in its history. The boom dates from February 13. On that day, 15 miles southwest of Alberta's capital city of Edmonton, Imperial Oil's Leduc 1 swabbed into production. The well came in with an initial of 1000 barrels daily to mark discovery of the brightest "light crude" prospect in Canada since the opening of Turner Valley as a major oil field 11 years ago.

Because Leduc caught the imagination of the oil industry and the nation, Canada's current oil boom dates from its discovery. The foundations of the boom, however, are built on more than Leduc. Its base includes other important field discoveries and the wealth of knowledge gained from expenditure of millions of dollars on oil and gas exploration the past decade.

The base includes the Lloydminster area, straddling the Alberta-Saskatchewan border, where exploratory drilling in 1946 indicated a major reserve of heavy crude, a reserve being rapidly developed in 1947.

It includes: The Princess area in southern Alberta, established as a great natural gas reserve, and offering promise of substantial oil production.

Viking-Kinsella in central Alberta, established in 194 as a huge natural gas reserve covering 300,000 acres.

Pakowki, 1946 gas discovery in southeast Alberta being developed in 1947, and Manyberries, a 1947 gas discovery to the east of Pakowki.

Turner Valley, Canada's first major oil field, which has now passed its peak, but still continues to give evidence that the limits of the field haven't yet been reached.

Jumping Pound, Alberta Foothills structure north of Turner Valley, which has been established as a great wet gas reserve. And many another lesser area in Alberta.

The first half of 1947 marked the beginning of the greatest oil and gas exploration program in Western Canadian history; greatest in respect to total area being actively worked by geological and geophysical parties; to number of drilling rigs in operation; to number of major and independent companies actively engaged; and greatest in respect to rate of monies expended.

During the last decade, and at an increased tempo during World War II, more than $50 million were spent on Western Canadian oil and gas exploration. In terms of production, the payoff was mediocre. In 1946, there came the first signs of a slowdown in exploration, but in that year and in early 1947 came the most encouraging results of any comparable period to date.

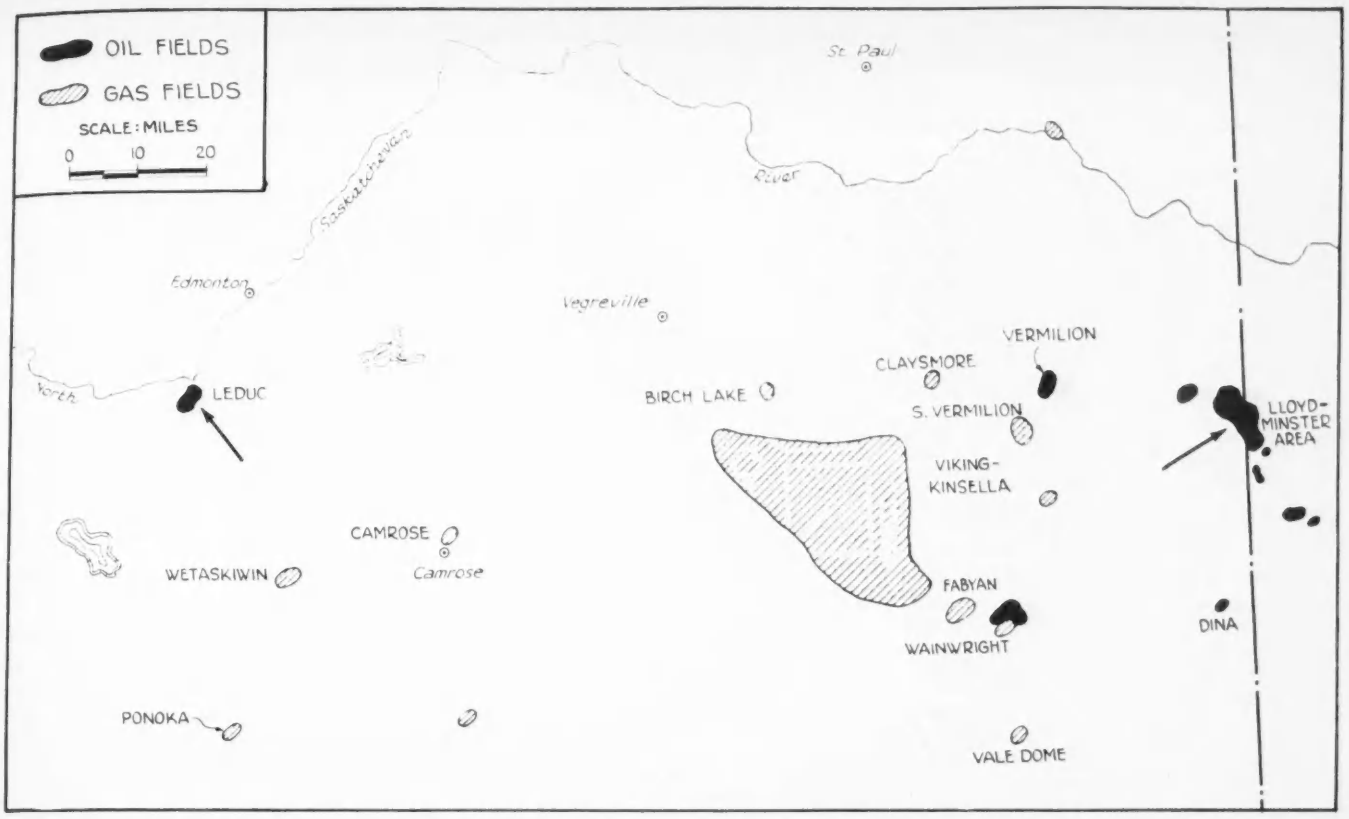
The wave of encouragement, combined with the increasing urgency for new sources of petroleum products in North America, had an inevitable effect. The slowdown ended. With one exception, budgets of all the majors long active in the West have been sharply boosted in recent months. Other majors, who have been viewing Canada from the sidelines, are showing considerably more interest. Independents, slowed down previously by declining revenues from their Turner Valley wells and difficulties in raising new capital, have in 1947 found the Canadian public able and more willing to provide substantial amounts of risk capital for oil and gas exploration. The result: Oil boom in Western Canada.

Leduc

By September 1, 6½ months after its discovery, Leduc was an important oilfield. Imperial Oil followed up its discovery with three extension ventures, one of them 1¼ miles south, another a mile southeast, another two miles northeast of the initial success. All three found the discovery zone oil-saturated, but with porosity poorly developed, but all went on to find initial flows of 1000 to 1500 barrels daily in a highly porous zone 150 feet deeper, to open up a second and more important producing section in the Devonian. By September 8, Imperial had completed and placed on production quarter-mile offsets to each of its first four successes. All show potentials in the 1000 to 2000-barrel range.

With the exception of very brief flush runs, all Imperial wells have been operated under tight restrictions since completion, at rates ranging from 100 to 250 barrels daily. All have gas-oil ratios in the range of 350 to 600 cubic feet per barrel. All are making water-free oil with a gravity 40 to 41 degrees API.

Table 1 shows the performance from inception to the end of August of the first seven Imperial wells. The eighth



producer started production September 6.

On August 30, two independents scored the ninth success at Leduc, and the first one outside of Imperial's straight run of successes. The well, Globe-Leduc West 2, extended the producing area 1½ miles northwest of the area proven by Imperial. It was placed on production with an initial flush flow of 158 barrels the first hour, largest to date. Completed in the lower Devonian productive zone, the D3, this well is producing from the interval 5270-84 feet. The upper zone, D2, also showed oil at this well (about 600 feet oil rise in one-hour drill-stem test), but was cased off. The upper zone will be thoroughly tested at a quarter-mile offset by the same team this fall.

At the beginning of September, the proven area at Leduc was about four miles in length and ranged up to about two miles in width. On the basis of 40-acre drill sites, the area contains between 80 and 100 locations regarded as proven.

The Leduc picture has been to a certain extent rounded out by establishing the oil-water level in both producing zones, and by the failure of several independent extensions drilled to the east of the producing area. The two failures to date closest to the producing area (B.A.-Pyrcz 1 and Leduc Consolidated 1, about one-half mile east of production) found the upper zone (D2) at a favorable elevation, but porosity was very poorly developed. The intervening section thickened, and D3 came in below the water line for that zone. The other two failures (Homestead-Yaremko 1 and Okalta-Leduc 1, two to 2½ miles east and southeast of the producing area), found water in D2, where porosity was well-developed.

On the basis of the information so far available, a porosity pinchout appears to be the governing factor in the oil-accumulation in the upper (D2) zone. The lower zone (D3) is now regarded as a Devonian reef condition, eastern production limits being governed by the reversal shown at the two closest independent failures.

12 Rigs Working

Currently, Imperial has five drilling rigs working in the field, while independents have seven. From ten to 12 weeks are required to drill a well to the 5000 to 5400-foot productive levels. Imperial alone plans to complete 21 wells by year's end. While the bulk of independent holdings have been knocked out of the picture by the delimiting of the pool accomplished to date, about 12 independent sites lie within the proven and probable area. Several independent successes are anticipated this winter.

Leduc's oil occurs in Devonian dolomite, in a section comparable with the Devonian oil sources at Princess, 200 miles southeast. At Leduc, wells pass directly from Lower Cretaceous into the Devonian at drilled depths of 4300 to 4500 feet. The top 420-435 feet of Devonian consists of limestone and dolomites, containing varying porosity at wells drilled to date. Porosity in the basal 150 feet of this section, now classed as the "D1" zone, contains water. Results are variable in porosity in upper portion, ranging from mixtures of oil, gas and water; dry gas; and shows of oil with gravity range 20 to 25. Below this occurs 110-150 feet of anhydrite, followed by 30-40 feet of red shale.

Immediately below the red shale member, and around 550 to 600 feet below the Devonian top, is a 150-foot section of limestone and dolomite, showing varying porosity. This zone, now

TABLE 1

Record of Imperial Oil Production at Leduc Since Inception to August 31, 1947

(Figures in Barrels Monthly)

WELL	February	March	April	May	June	July	August	Total
Well 1	4,187	4,877	709	5,058	5,144	5,299	3,036	28,310
Well 5	.....	.....	.....	.....	.....	1,564	3,028	4,592
Total D2 Zone	4,187	4,877	709	5,058	5,144	6,863	6,064	32,902
Well 2	.....	.....	.....	1,197	4,562	7,072	6,117	18,858
Well 3	.....	.....	.....	1,200	4,110	4,414	4,986	14,710
Well 4	.....	.....	.....	.....	3,702	5,207	5,288	14,197
Well 6	.....	.....	.....	.....	.....	76	5,302	5,378
Well 7	.....	.....	.....	.....	.....	.....	2,632	2,632
Total D3 Zone	.....	.....	.....	2,307	12,464	16,769	24,325	55,775
Field Total	4,187	4,877	709	7,365	17,518	23,632	30,389	88,677

TABLE 2

Lloydminster Production and Producing Well Record for First 7 Months 1947

	ALBERTA						SASKATCHEWAN							
	Blackfoot		Lloydminster		Total		Lloydminster		Lone Rock		Total		Total Field	
	Wells	Barrels	Wells	Barrels	Wells	Barrels	Wells	Barrels	Wells	Barrels	Wells	Barrels	Wells	Barrels
January	2	1,541	11	5,290	13	6,931	21	19,725	..	.....	21	19,725	34	26,756
February	3	2,190	10	4,939	13	7,129	18	17,247	1	100	19	17,347	32	24,476
March	4	3,272	12	7,314	16	10,586	21	20,380	1	379	22	20,759	38	31,345
April	5	4,524	12	5,593	17	10,117	23	23,415	2	109	25	23,524	42	33,641
May	10	10,217	16	8,769	26	18,986	29	30,757	7	4,835	36	35,592	62	54,578
June	15	17,124	19	8,349	34	25,473	34	38,525	9	8,981	43	47,506	77	72,979
July	19	19,181	16	7,912	35	27,094	37	35,863	10	14,682	47	50,545	82	77,639
7 Months, 1947	..	58,049	..	48,266	..	106,315	..	185,912	..	29,086	..	214,998	..	321,313
Cumulative to 8-31-47	..	63,804	..	158,849	..	222,653	..	338,624	..	29,088	..	367,712	..	590,365

classed as the "D2," was the source of the discovery at Imperial-Leduc 1, and the production at Imperial 5. Porosity was too poorly developed at Imperial Nos. 2, 3, 4, 6, 7 and 8 to yield commercially, at least without acidization. Oil from this zone tests 40 to 41 gravity.

Underlying the D2 zone is a green shale ranging from 140 to 150 feet in thickness. Immediately below this, and from 850 to 925 feet below the Devonian top, is the D3 zone, a section of limestone and dolomite at least 140 feet in thickness (that being the maximum penetration to date, at Imperial No. 3). The variable porosity in this zone is yielding the 40-41 gravity oil at Imperial Nos. 2, 3, 4, 6, 7, and 8.

Above the Devonian, the Leduc field shows natural gas in large volume at several wells in the Viking sand of the Upper Cretaceous (around 3400 feet), and shows gas and some light oil in a Lower Cretaceous sand around 150 feet above the Devonian contact. So far, the only development of these upper zones has been the drilling of a Viking gas well by Imperial to provide fuel for field drilling. That well (Imperial 10, quarter of a mile west of No. 3) completed July 21 with a drill-stem test at 3446-57 feet showing gas at the rate of 3000 Mcf daily.

So far, all Leduc production has gone to the Imperial Oil refineries at Calgary, 200 miles south of the field, and at Regina, 600 miles southeast.

Indicating how Imperial rates the discovery, it has purchased a site on the outskirts of Edmonton, 15 miles north of the Leduc field, and is drafting plans for a 10,000-barrel capacity refinery to utilize the field's crude, and service the northern section of Alberta, currently supplied from Calgary. An eight-mile, eight-inch pipe line is being laid to connect the field with the railway at Nisku, east of the field.

Early in July, Imperial posted a price for Leduc crude—well-head price being $2.67½ per barrel for the 40-41 gravity product. This compares with $2.96 for similar gravity oil in the Turner Valley, which connects with Calgary refineries by pipe line.

Lloydminster Area

The Lloydminster area, on the Alberta-Saskatchewan border, was indicated as a major reserve of heavy (12 to 19 gravity) crude in 1946, when a series of widely spaced wildcats obtained commercial oil production along a line running 27 miles northwest and southeast, and ranging in width up to ten miles. In 1947, exploitation of that reserve got under way.

During the first eight months of this year, 112 wells completed drilling, with 98 of these indicating commercial production, and 14 being failures. The program got into full swing in May, when 21 wells completed (19 successful, two failures). In June there were 20 completions, 16 successful, four failures; in July, 24 completions, 19 successful, five failures; August, 20 completions, all successful.

Source of Lloydminster's production is a series of sands in the lower Cretaceous, at depths ranging from 1700 to just over 2000 feet. Most important of these in the Sparky member, a series of interbedded oil sands and shales ranging up to 100 feet in thickness. Bulk of production is in the 14-15-gravity range, with some oil in the Lone Rock (southeast) extension ranging up to 19 gravity. Average initial yield of wells placed on pump in 1947 has been about 50 barrels daily, with an occasional well showing an initial up to 160 barrels per day. Most of the newer completions show a basic sediment and water cut ranging from ½ to 3 percent. Many older wells—due at least in part to faulty completion and operating procedures—have b.s.&w. cuts ranging from 20 to 50 percent.

Prime deterrent to Lloydminster development prior to 1947 was the limited market available for this type of crude. Its only important outlet was railway fuel oil. In 1946, the Husky Refining Company of Wyoming looked at Lloydminster, and decided it liked the prospects. Based on its experiences in Wyoming, where it had developed a large market for asphalt and other products derived from heavy crude, Husky saw a bright future in Western Canada for a similar line of products from Lloyd oil. It commenced construction of a $700,000 cleaning plant system and asphalt plant with initial capacity of 2500 barrels daily at Lloydminster. This plant began operations in July. Excelsior Refineries, Ltd., operator of Lloyd's first 1000-barrel capacity cleaning unit, also started a plant expansion in 1947.

To top off the sharply improved marketing picture, in July Imperial Oil and British American Oil Company, the leading refiners and marketers in Western Canada, have undertaken to take delivery of 50,000 barrels monthly each of Lloyd crude, when and if available.

As yet Lloyd production is substantially below the indicated market, though it has been climbing steadily since the first of the year. In July, net oil deliveries from 82 wells totalled 77,639 barrels. At present, the number of wells capable of producing is about double the number which actually produced in July, and current productive potential is believed to be considerably over 100,000 barrels monthly. Actual production is expected to pass that figure shortly and, with rapid development continuing, productive potential is expected to increase further.

During the first seven months of 1947, net oil deliveries from the Lloydminster area totalled 321,377 barrels, which compares with 213,041 barrels during the full year 1946, and represents more than half of all the oil produced from inception of the field to the end of July (total 590,365 barrels).

The currently producing region conveniently breaks down into three principal pools, Lloydminster (straddling the Alberta-Saskatchewan border), Blackfoot (several miles west in Alberta), and Lone Rock (some miles southeast in Saskatchewan).

Table 2 presents a breakdown of oil deliveries and number of wells operated by pools and provinces for the first seven months of 1947.

The first schedule of posted prices for Lloydminster crude was published by Husky Refining Company on May 23.

A price of $1.15 per barrel was established for crude under ten degrees API, with a 2-cent differential for each degree increase up to $1.27 for 20 degrees and over.

Macmillan Plans to Test Holdings In Sicily

With a definite plan of selecting the most favorable locations for initial test wells on the area now held by it in Sicily, Macmillan Petroleum Corporation of Los Angeles is continuing its geological study of the several blocks of acreage covered in permits issued by the Italian government, it was announced by J. H. Macmillan.

More than 70,000 acres are comprised within the permits granted by the government at Rome. The land is in six blocks, a total of 28,400 hectares. The selections of these tracts have been made by Dr. E. K. Soper, petroleum geologist, on behalf of the Macmillan Corporation. In his opinion they are the most attractive areas within the borders of the island for production possibilities.

Macmillan company began to investigate the petroleum possibilities of Sicily in 1943. Its interest was focused on the Italian situation when geological reports made a number of years ago by eminent engineers were brought to the attention of its officials. These reports had been made on behalf of large oil interests and at that time concessions were granted by Mussolini on practically all of Italy and Sicily to Sinclair. Exploration parties, under the direction of Dr. Soper and including J. P. McCulloch, manager (administration) of The Texas Company's foreign operations, Production Department, has devoted many months to a study of oil possibilities of both the mainland and Sicily. Dr. Soper, who has been professor of geology at the University of California at Los Angeles for many years, was active at that time with Sinclair and made a particularly comprehensive study and report on Sicily. Owing to differences arising between Mussolini and the American oil company in possession of the nationwide concessions, Sinclair withdrew from Sicily, and no drilling or further development was carried on.

A report on Sicily's possibilities by Soper, with its supplemental findings and conclusions, was the incentive that prompted the Macmillan Corporation to seek concessions in the Italian area. The company realized the uncertainty of the stability of an Italian government during the late war period, and afterwards, and acted only with guidance of the U. S. State Department.

During the past two years, Franco Fenzi, the Macmillan representative in Rome, concluded negotiations with the Italian government. All necessary documents have been issued and at this time additional and more detailed geological study is under way through the guidance of Dr. Soper, who has recently resigned from the University of California at Los Angeles, and is now with the Signal Oil & Gas Company of California. Macmillan, through Engineer Fenzi, has been successful in "borrowing" the services of Enzo Beneo, geologist in the employ of the Italian government. Beneo is now carrying on a study of the various tracts in the Macmillan holdings, for the purpose of collaborating with Dr. Soper in the selection of the proposed drill locations.

Macmillan's activity is one of several developments of importance in the Italian oil industry.

Standard Oil Company (N. J.) has made an official application to the government for prospecting rights over a wide area of Northern Italy, stretching from Milam to the Adriatic coast, and covering more than 4 million acres.

Deep Pay Possibility

It is possible that the discovery of large quantities of natural gas without oil in the Po Valley which has been a feature of previous prospecting in Italy, may be due to the fact that only the uppermost portions of deep-lying structures have been tapped, and that oil exists in commercial quantities at greater depths.

A number of Italian firms have been working for years on very small concessions of not more than 1200 acres in extent, which have never been drilled to greater depths than 4500 feet.

The search for oil in Italy is being carried out in Lombardy, Tuscany and Sicily, as well as in the Ferrara district. In Lombardy, prospecting is being carried out by the Azienda Generale Italiana Petroli (AGIP) especially in the Lodi district near Caviago, and in the Piacenza district near Podenzano and San Giorgio. Five wells have been drilled in the Lodi area and a sixth is in progress at Rifalda near Crema. The latter is expected to be carried to 9000 feet. It already has tested large quantities of natural gas at about 4500 feet. It is reported that the AGIP has received offers from British oil interests who desire to cooperate in prospecting work in the Lodi area.

In Tuscany exploration is being carried out by the Societa Idrocarburi Nazionali, a subsidiary of La Centrale electric company, which has drilled a number of wells at Pietramala to depths between 3000 and 4500 feet, as well as one well in the Appenines in the Forli area.

In spite of the current exploration activity, the production of crude in Italy is still small, being only about 5500 barrels a month. The Italian Ministry of Industry and Commerce estimate that about 29 million barrels of petroleum products must be imported during the current year, and that this figure will rise to 43 million in 1951 unless substantial quantities of local products are discovered in the interval.

Much progress has been made in the rehabilitation of the Italian refineries during the current year. The Bari, Naples, Trieste and Venice refineries are in operation and an agreement has been made between Standard and the Azienda Nazionale Idrogenazione dei Combustibili to provide crude for the Bari refinery when UNRRA supplies cease. Although part of the Bari refinery is in operation, it now handles 210,000 barrels of crude a month. The hydrogenation plants are not in use owing to the present high cost of operation. The reconstruction of the Leghorn refinery has been partially financed by the Italian Petroleum Board (Comitato Italiana Petroli), and by the end of this year it will be able to handle between 70,000 and 80,000 barrels of crude oil a month.

If the terms of the 1936 convention between the ANIC and the Italian government are adhered to, the Bari, Leghorn and Novara plants should become the property of the state at the end of 1948.

The agreement which has been reached between AGIP and the Anglo-Iranian Oil Company for the formation of IROM (Industria Rafineria Olii Minerali) constitutes further addition to Italy's refining capacity. AGIP's Venice refinery will be put at the disposal of the new organization and Anglo-Iranian will contribute a large quantity of crude for processing. The Venice refinery has a capacity of more than 3½ million barrels a year and is ideally situated to supply the leading industrial centers of northern Italy.

A contract has been signed with Roumania to supply Roumanian oil to Italy in exchange for merchant shipping and rolling stock, and the Azienda Petrolifera Italo-Romana (APIR) will construct a refinery to handle this Roumanian oil in Italy.

RUSSIA COMBATS DECLINING PRODUCTION

In Baku Fields

PERCENTAGE figures supplied by the Russian press on planned production for 1950 in relation to 1945 indicate that the war years brought about a serious decline in Russia's output. From the 1945 figure of 138 million barrels it is possible to calculate 1946 production at 12 percent higher, or 153,900,000 barrels. This decline cannot be accounted for by the destruction of Maikop and Grozny during the war, since the two areas together furnished only 38,250,000 barrels in 1940, and the non-Caucasian fields increased their output by almost 1,500,000 barrels.

According to an article in *Foreign Commerce Weekly*, which took as its basis an official study made by a Soviet economist in *Planovoye Khozyaistvo*, political-economic journal of the State Planning Commission of the USSR, the heavy net loss in Russia's crude production can be traced to a decline in the effective exploitation of the Baku oil fields. Baku's 1945 output has been calculated at 85,500,000 barrels as compared with an output of 157,500,000 in 1940, when the country as a whole produced 232,500,000 barrels.

The Soviet petroleum economist states that Baku production dropped sharply with the outbreak of war. More than 1000 wells ceased operations during 1941 and 1942, as the difficulty of transporting oil out of the area increased. A larger number of wells closed down for lack of repairs, due both to a shortage of repair crews and replacement parts. Inferior maintenance resulted in a drop in the output of the wells remaining in operation, whose technical condition was not improved by attempts to make repairs with used equipment transferred from inactive wells. This dismantling subsequently increased the difficulty of returning inactive wells to operation.

Improvement in 1943

Conditions in Baku began to improve in 1943. Drilling and prospecting were resumed and workshops were repaired, petroleum machinery was manufactured, and by the end of 1944 Baku oil production had ceased to decline.

Postwar recovery of Baku's oil industry has, however, been very slow. Despite the enormous reserves of the Apsheron Peninsula, the marine deposits in the Caspian, new fields in Neftechala, Kirovobad and elsewhere, the confirmation of 1946 prospecting that indicated existence in the area of large oil fields that have not yet been sufficiently studied, and despite the fact that the Soviet petroleum industry in 1946 increased 12 percent over 1945, the increase in the Caucasus and particularly in Baku has been negligible.

This slow recovery the Soviet article attributes not so much to the impact of war as to defects long present in the petroleum industry of Baku.

One of the main defects cited is that prospecting consistently lags behind development. There were so few prospected reserves at the beginning of the war that in 1941 they were not sufficient to meet even a quarter of the yearly plan of new wells to be brought into operation. Consequently, the low-yield wells were exploited in ever-increasing numbers, and as a result there was a decline in the total yield of the fields. The situation continued and was intensified during the first years of the war when prospecting ceased and no high-yield wells were developed.

The proportion of prewar drilling for prospecting was 20 percent, which practice has shown to be much too low for Baku. In order to cover current plans it will have to be upped to 25 percent, and to have reserves for two or three years in advance the proportion must be at least 40 percent. By 1950 the proportion of drilling done for prospecting purposes will be 41 percent, but in the first years of the Five-Year Plan it must be higher, so that in 1947, for example, it should amount to 50 percent of the total sinking operations.

The plans for survey drilling are not being fulfilled. The 1945 plan was only 63 percent and the 1946 plan only 67 percent fulfilled. The volume of prospecting drilling in Baku in 1946 was less than in 1940. In the last quarter of 1946 drilling operations decreased by 9 percent instead of expanding, though the number of drilling rigs which were used by prospecting increased by 38 percent at the end of the year.

Operators of Azneft, the Azerbaidjan Oil Trust of which the Baku oil industry is a part, lay the slow recovery of the region to shortage of materials and equipment, particularly of casing pipes and special barites, though there are large barite deposits in the three Caucasian republics of Azerbaidjan, Georgia and Armenia. The Azneft and Kirovabad prospecting trusts also have failed to use a satisfactory substitute—the magnetite sand from the Black Sea shore. Drills have been idle for want of weighting compounds while 3 million tons of ground magnetite sand have accumulated at a milling works in Baku. The delivery of timber, building materials, casing pipes, electric motors, and other equipment fell short of the plan.

If the 1947 volume of prospecting drilling operations is to be almost double that of 1946, as planned, the speed of drilling will also have to be stepped up. In 1946 the average speed of drilling in prospecting operations was only 6000 feet per month per machine, which was 8675 feet less per month than in 1945.

Excessive use of the natural pressure method is blamed by the Soviet author for low output of Baku. No attemp is made with this method to maintain pressure by pumping gas or water into the stratum; consequently, the pressure falls rapidly, the period of flow is short, and the decline in output sharp. Moreover, secondary methods of recovery are not employed. More than half the reserves remain in the ground and thousands of wells decline in yield much too early. The vast reserves at Apsheron made it possible to employ successfully the wasteful but cheap natural-pressure method, which did not require any great investment of capital, or of materials and equipment that were always short. The oil-bearing strata were studied only from the point of view of geological deposits and method of production of oil. Experts generally did not know when any of the wells would cease to flow, so that the fields were unprepared for emergencies which occurred in the course of exploitation and the output of oil was not steady.

Losses at Baku

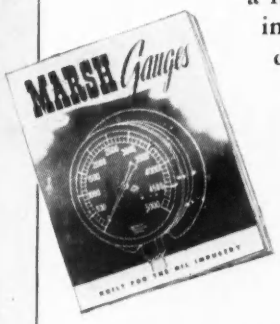
Some idea of the losses due to unwise exploitation at Baku can be estimated from the fact that in 1935 the yield from new wells put into operation during the year amounted to 42 million barrels,

"...by the company it keeps—"

If the best way to judge a product is by the company it keeps, Marsh Gauges are certainly at the top of the list throughout the oil country.

There is no deep mystery as to why this should be so. The need for pressure gauges that would stand up in the tough going of the oil country was right there to be met; and Marsh experience stepped in and met it with instruments that were certain to win the vote of men who recognize quality, precision and stamina in pressure gauges.

Because Marsh Gauges are in demand throughout the industry, they also keep good company in the channels of distribution. Your local supply store has a full line of Marsh Gauges for the oil industry—gauges that are engineered down to the last detail for every service encountered. A number of these gauges are illustrated here. Ask your supplier for the new Marsh Bulletin, "Gauges for the Oil Industry."

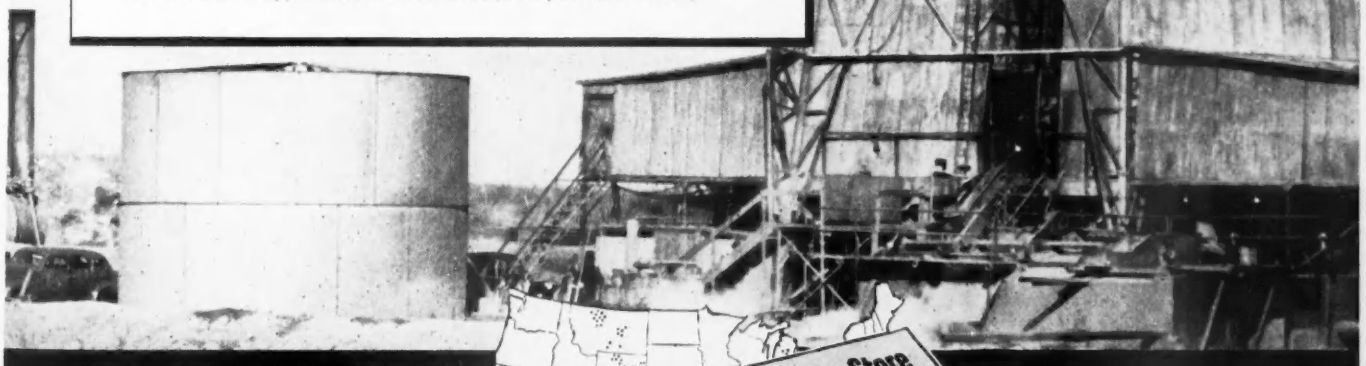


JAS. P. MARSH CORPORATION
2045 Southport Ave., Chicago 14, Ill.
Export Dept.: 155 E. 44th St., New York 17, N. Y.

● The Marsh branch plant at Houston offers shipment from stock and facilities for repairing all makes of gauges.

The Marsh line includes gauges especially designed for blenders, boilers, burners, capping, Christmas trees, columns, heaters, hydrogen units, instrument panels, pumps, Reid vapor bombs, scrubbers, separators, mud pumps, stills, towers and other applications in all branches of the petroleum industry.

The Marsh Mastergauge, guaranteed accurate within ½ of 1% of reading—a precision gauge for a precision industry.



MARSH GAUGES

plus 8,250,000 barrels from idle wells restored to operation, but that the total output of oil from old and new wells increased a mere 1,185,000 barrels over the 1934 total. In 1939 new and restored wells produced 33 million barrels of petroleum, but the total output at Baku fell by 4,185,000 barrels. In 1940 the total increase in the output was only 4,710,000 barrels, although an additional 34½ million barrels were produced by new and restored wells.

Constant drilling and the regular bringing into production of a large number of highly productive wells compensated for this decline before the war, but with increasing neglect of prospecting the level of output could not be maintained. The task finally became impossible when prospecting ceased during the war.

Azneft still is not fulfilling the plan for putting old wells back into operation. In 1945 it achieved only 58.7 percent of success and 64.2 percent in 1946. The number of wells restored to operation in Baku last year was less than in 1945.

Inadequate technological levels prevailing in prewar years in Soviet production of petroleum equipment, particularly that of refineries, is another reason given by the Soviet author for the slow development of the petroleum industry. A number of key parts had to be imported from abroad, and it is only since the war's end that Russian factories have begun to porduce the special bearings required for deep-drilling rigs. The pipe mills likewise have failed to meet the industry's requirements. Nor has the technology of other equipment factories advanced as much as planned.

Construction of a pipe rolling mill was started during the war at Sumgait, near Baku. Most of the prewar plants within the jurisdiction of the oil industry have been expanded and new factories built. A number of factories belonging to other ministries, such as Heavy Machinery, Transportation Machinery, Agricultural Machinery, Armaments, Tools and Small Machinery, Electrical Equipment, and Automobile Production, have undertaken the manufacture of machinery and equipment for the petroleum industry. Russia has hopes of remedying the decline of Baku production, now that awareness of the condition exists.

Second Oil Well In Chile's Springhill Field May Prove Equal to Discovery

THE Springhill field on the island of Tierra del Fuego, in Chile, now has its second oil producer with the completion of Springhill 7. The well has not been gauged, due to insufficient tankage for extended testing, but it is reported capable of production equal to any in the Springhill field.

The discovery itself, completed more than a year ago, is yet to receive a potential test officially, but observers familiar with the area indicate it is capable of producing perhaps 1500 barrels daily, initial flow, while detailed reservoir information is lacking in sufficient amount to be able to estimate the rate at which it might flow on regular production. This is estimated at somewhere between 300 and 700 barrels a day. The No. 7 well is showing tubing pressure of 1200 pounds on initial tests and should flow at approximately the same rate.

Of the seven wells drilled to date, only two have been dry holes, while the remaining three have been gas wells. On the basis of facts derived from wells already drilled, the field is being defined and some of its characteristics revealed. The second well, drilled to the northeast, was a dry hole, and the third well, considerably west of discovery, is apparently on a gas cap overlying the top of the anticlinal structure. Well 5 was drilled still farther west and resulted in gas production, while the sixth well between Nos. 3 and 5 also produces gas. Meanwhile, No. 4 had been drilled to the east, apparently too low on structure and below water level, and was dry. The most recent well, No. 7, is just south of the discovery, running just about level and a comparable oil well.

Oil Outlook

The theory now advanced, and being borne out by geophysical work in progress, is that the oil horizon lies in a band around the structure, the center being in a gas cap, and perhaps not more than a quarter-mile in width around the structure, between the oil-gas contact and the oil-water contact.

It is estimated that there will be perhaps 20 or 25 and perhaps as many as 30 good oil locations in the field when completely defined, which, if they are capable of the same kind of production as the first two oil wells, should furnish an ultimate outlet of 7000 to 10,000 barrels daily. Other products should be available from the gas-producing area, since the gas is quite rich in condensate. After being shut in for a period, the gas wells flow pure gasoline before they start making all gas. No present plans for processing the gas have been announced, but this is thought of as a future possibility. Tentative plans call for a plant with a capacity of 10,000 barrels daily.

Currently the daily consumption of petroleum and products in Chile is between 6000 and 7000 barrels.

Two rigs are now active in the field, both purchased from Livermore Drilling Company following discovery of the field, with Livermore still directing actual drilling on a contract basis. One of the rigs is capable of drilling to 15,000 feet, and it may be used for wildcat drilling following completion of more geophysical work. However, for the time being, the one crew not active there is now occupied with a detailed survey of the field and vicinity.

Promising Structures

Mainly through surface geology, a number of promising structures have been worked out on the mainland of Chile, and a new rig said to be on the way from the U. S. is scheduled to be put to work on one of these locations. The first probably will be in an area about 30 miles or so northwest of Punta Arenas, and about 100 miles west from the Springhill field. A preliminary drilling operation was started there during the early part of the year, using cable tools, but it was shut down to await delivery of a rotary rig before starting up again.

In the Springhill field itself the No. 8 well is drilling below 4000 feet and should be on the sand very soon. Northeast of the discovery and in line with the second test, No. 8 is expected to be a producer if the theories worked out for the area prove correct.

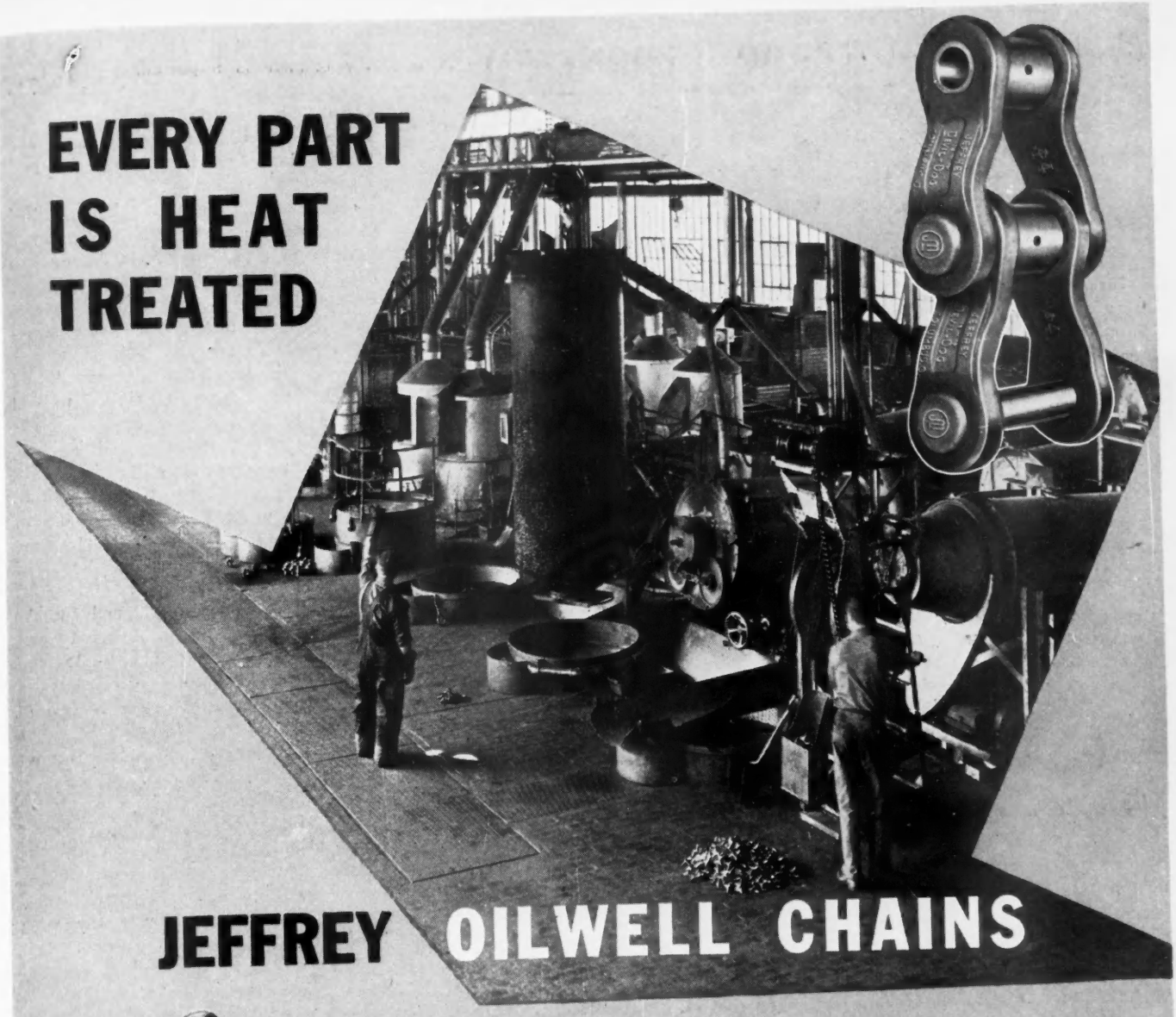
Two Firms Registered for Exploration in Australia

Two new prospecting companies have been registered at Melbourne, Australia. The Frome-Broken Hill Company will search for natural gas near Broken Hill, and the Boneparte Gulf Company will seek oil in the Northern Territory. Both have a nominal capital of £150,000 in £1 shares and in each case 50 percent of the capital will be held in equal amounts by the sponsors, the D'Arcy Exploration (Anglo-Iranian), Vacuum Oil and Zinc Corporation.

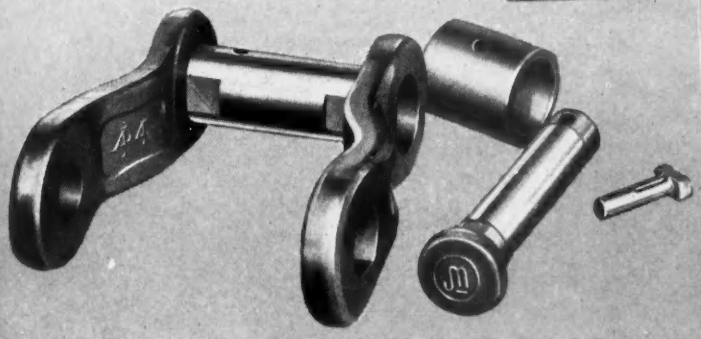
Swedish Test Drilled

Exploratory drilling has begun near Trelleborg, in the south of Sweden by the government. Drilling activities near Haparanda, in Northern Sweden, which have been going on without success for several years, have now been discontinued.

EVERY PART IS HEAT TREATED



JEFFREY OILWELL CHAINS



In this modern Jeffrey heat treating plant, each separate part of Jeffrey Oilwell Chains is given the specific treatment that best suits its particular function. The result is tougher, longer-wearing, more economical chain.

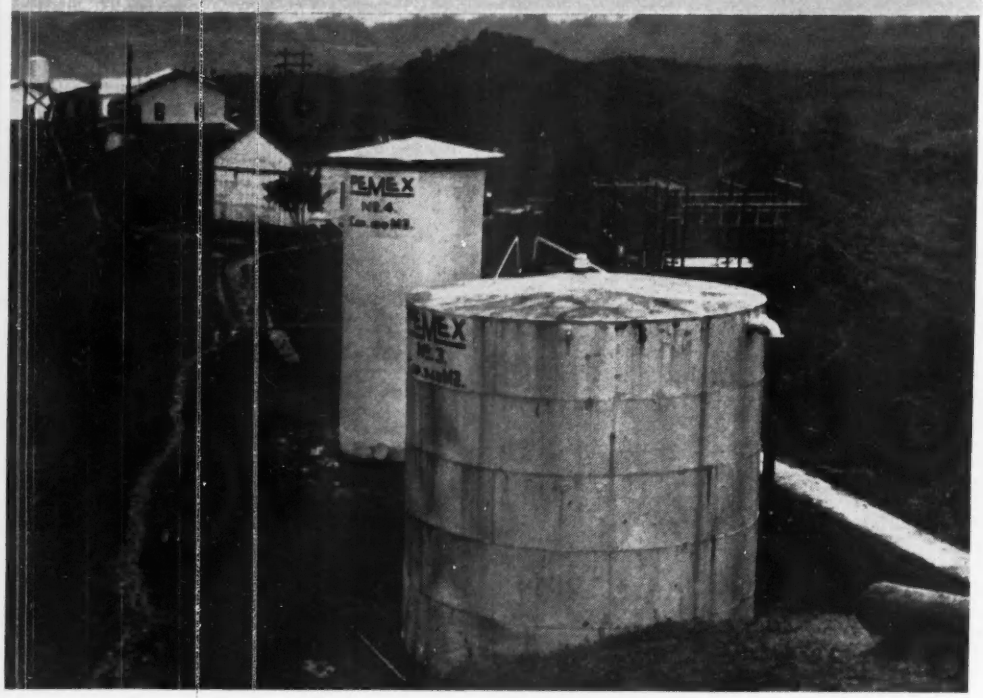
JEFFREY

ESTABLISHED 1877

THE JEFFREY MANUFACTURING COMPANY, 985-99 North Fourth Street, Columbus 16, Ohio

Mexico Pushes Expansion Of Oil Operations

Pump station on Poza Rica-Mexico City pipe line. The original reciprocating pumps will be used for new parallel line for which material has been purchased.



IMPORTANT expansion of facilities and operations is being pushed in Mexico. Negotiations with contractors contemplate sharply increased drilling and vigorous efforts to establish new fields. Poza Rica gas will be piped to Mexico City. Expansion will include refinery construction at Salamanca and Guadalajara and new crude pipe lines to serve them. Increased domestic consumption and exports make expansion of the industry urgent.

The steps that are being taken toward expansion of Mexico's oil industry were discussed by Antonio Bermudez, general manager of Petroleos Mexicanos, before a group of business men at the middle of the year. His discussion is here summarized.

Petroleos Mexicanos has been increasing the number of geological and geophysical parties in the field until there are 30 geological parties and 12 geophysical parties at work. Seventy-four large structures have been located by some of the world's most famous geologists—among these being E. De Goyler. These structures have not yet been put to the test for it must be realized that each structure may need from one to 100 wells or more in order to be proved.

After the expropriation in 1938, the war interfered with the obtaining of materials and equipment for drilling. Nevertheless, the work has been continued and is being continued to such an extent that although Pemex's 1946 production averaged 126,000 barrels per day, actual production now is 164,000 barrels per day. With an interior consumption of 107,000 there remains a surplus for exportation which, in accordance with the desires of the president of the country, will serve to increase the dollar balance, now that the cattle and mining industry are not producing as much as before.

In the refinery at Atzcapotzalco there are 40 million liters of gasoline constantly in storage. There are 110 million liters of gasoline in storage in various parts of the republic with storage of other products in proportion. On the Pacific coast there has been a scarcity of fuels because of transportation difficulties. Forty-two percent of the consumption along the coast of Sonora and Sinaloa is supplied now by Pemex and the balance is imported.

The income of Pemex has increased considerably due to the better service being received from the railroads and to the large production of the new Atzcapatzalco refinery.

There are 32 wells now being drilled —30 with Pemex's own equipment and two using equipment of American drilling contractors—and new wells are constantly being brought into production. In one month three new structures were found. In Camargo a new gas deposit has been discovered and the drilling is being continued to find oil. In Tabasco a new deposit of gas has been found and the well is being deepened to encounter oil. In Tlacolula, Vera Cruz, a well has been completed which will make 70 barrels per day of high-grade oil and two more wells were being drilled close by in the hopes of finding another Poza Rica.

A contract has been signed for the drilling of 100 wells in different parts of the republic, and if only 15 percent should result in productive wells, this would mean a source of income of great importance. Negotiations were being made with other contractors for an even greater number of wells.

These definite figures demonstrate the brilliant future before Pemex. Someone has said that there is no reason why Mexico should produce only 164,000 barrels per day while Venezuela has 2 million. The reason is that the wells have not been drilled in Mexico.

The project of building a gas line from Poza Rica to the Mexico City is being pushed. A contract has been made with Altos Hornos for 24,000 tons of pipe for this line and this material is expected to start deliveries during the coming month. When completed, the gas from this project is expected to realize 100,000 pesos per day. Plans have been completed for the oil line from Poza Rica to Salamanca and this work will soon be started. This week we expect to sign the contract for the refinery equipment for Salamanca. A little later, a line from Salamanca to Guadalajara will be put in to supply a refinery in Guadalajara. Plans are being made to increase the production of light products by the company, in accordance with the most modern techniques.

The President of the republic is personally following the progress of Petroleos Mexicanos with great interest and has left word that he is to be advised at any hour of the day or night when a new well is brought in. The program of Pemex is to deliver fuel and all the other products of petroleum to every section of the country for the service of all inhabitants without exception.

PERU'S PRESIDENT ASKS

Liberal Oil Policy

Many major units of the oil industry are awaiting with considerable interest the disposition of the new petroleum legislation to be acted upon by the current session of the Peruvian Congress. Liberalization of the present petroleum policy to permit freedom of operation in favorable areas likely would show an immediate resultant stimulation of activity on the part of the international oil operators.

In a message to the Congress, delivered at the inauguration of the Ordinary Session on July 28, 1947, President Jose Luis Bustamante y Rivero strongly advocated passage of the proposed revisions, and dwelt at some length on the possible benefits to his country.

A translation of that part of his message dealing with petroleum follows.

In the field of immediate possibilities, my Government concentrated its attention from the start on petroleum reserves. The honor fell to Peru, many years before the others, to be the first country in Latin America to obtain petroleum production in commercial quantities. The quality of the crude from all our oil fields known to date is excellent, and our petroleum products enjoy a justified fame beyond our borders.

Our potential oil reserves, particularly in the region east of the Andes, are also very large and offer splendid prospects of a return on investments in discovering and developing them. However, we have seen countries like Venezuela, and Colombia develop very rapidly and surpass us in volume of petroleum production, although our oil developments antedated theirs by nearly half a century. The favorable geographic position of those countries in relation to principal world markets had something to do with it, but doubtless also our restrictive petroleum policy of many years standing has been a contributing factor.

To correct this situation and open new potential oil areas to the initiative and experience of private oil companies on an equitable basis of a just division of the benefits with the state, the government has under consideration a project of general petroleum legislation for which a Petroleum Policy Commission was named which, in turn, contracted the services of an expert. This project is being given a final revision and will be submitted as a bill to Congress at the present Ordinary Legislature in order that it be given preferential attention.

It happens, gentlemen, that while on the one hand the last world war, corroborating and augmenting the lessons learned during the first world war, demonstrated the decisive importance of possessing and disposing of an abundance of crude oil and stimulated its use for specific ends, bringing consumption to unexpected levels; on the other hand, the termination of the conflict followed by diplomatic treaties between the interested powers and recent commercial agreements between the large British and American petroleum companies have removed obstacles to the development of the gigantic oil fields of the Middle East whose immense size was not previously appreciated.

Difficulties Seen

Its proven and estimated oil reserves amount to three times the amount previously estimated for the whole world. While oil production of the countries forming this privileged region is rising by leaps and bounds and pipelines are under construction to transport it to Mediterranean ports, thus avoiding the tanker run around the Arabian Peninsula, it is already discounted that the great European markets will eventually be lost to South American oil which had up to now been supplying the greater part of Europe's needs. Oil from the prolific Caribbean areas will be diverted to Atlantic ports of the U. S., and oil from the rich fields of the central part of the area will be routed to California, which was considered up until now as being the largest potential market for crude from the West Coast of South America. Consequently, obstacles are greater and interest is weaker in prospecting for and developing oil fields in this part of the continent. Such is, gentlemen, the present world petroleum panorama which, as you see, offers serious difficulties to be overcome by your patriotism and your wisdom when you consider petroleum legislation.

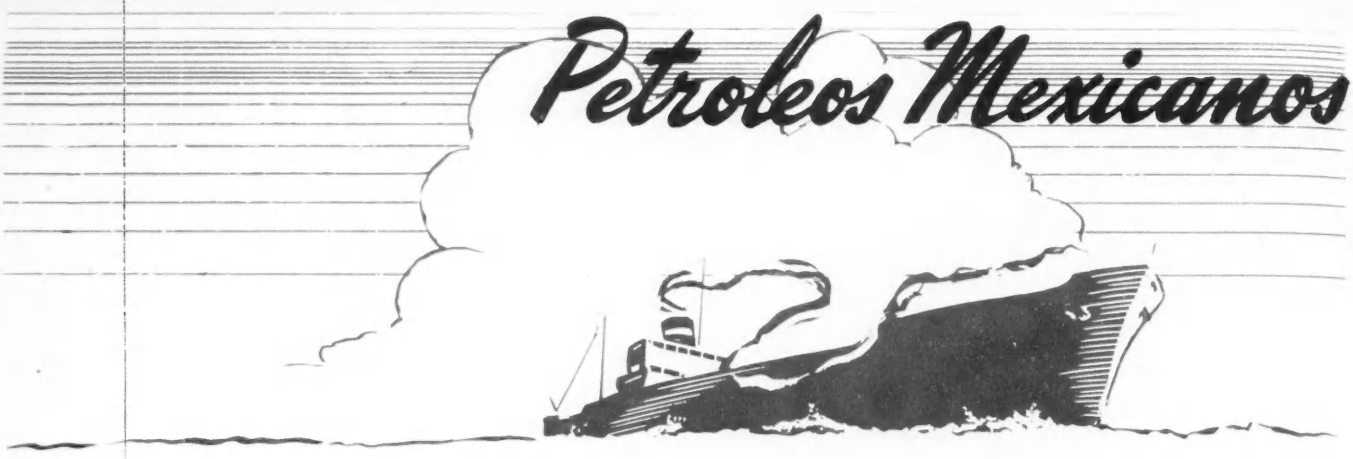
Under these conditions, it would be quite illusory for this country to develop its production on a vast scale and seek markets under world competitive conditions without assistance from major worldwide oil companies who possess the advantage of enormous capital, organization, means of transportation and storage, long-time contracts which open the doors to certain markets, and above all, of their very great experience. Therefore, the government has thought it necessary that the law establishing the Peruvian Petroleum Corporation be revised and clarified by Parliament in those parts which may offer doubts regarding the proposition that it may be construed as building a foundation of a state monopoly which would drive away the international oil companies. This government desires that the objectives of the corporation be clearly limited to the reserve zones actually under development by the Establecimientos Petroleros Fiscales, to zones which will remain as reserves under the new law and to the vast zone 50 kilometers wide along our borders, which, under the constitution, cannot be granted to foreigners.

However, the problem of our petroleum production is not only one of increasing volume of exports to secure foreign exchange, to balance our foreign commerce and maintain a balanced budget, it is also to assure our domestic market. Our needs in petroleum products are increasing rapidly, just as is the case the world over. In spite of war restrictions and present limitations on motor vehicles and machinery imports, consumption has increased so much that today it represents about half of our production, whereas before the war in 1933 it represented only 21 percent. At the same time our crude oil production since 1939 has dropped 8 percent; a situation which I am sure you will view with patriotic pre-occupation.

In the detailed report on the work of each Ministry that I am presenting to Congress on this date, you will notice statistical data which will convince you objectively of the urgent need of developing new fields to replace those which after many years of intense development, are showing signs of undoubted

■ CONTINUED ON PAGE 261

THE TANKER FLEET OF Petroleos Mexicanos



ONE of the principal problems that developed when the administration of Petroleos Mexicanos was constituted in March, 1938, was maritime transportation, particularly with reference to coastwise service, since the administration lacked any vessels for the transporting of liquid fuel.

There was an immediate necessity to acquire a tanker to satisfy the urgent requirements of the Port of Vera Cruz where fuel oil stocks had practically been exhausted and for that reason the Cuban tanker "Amolco" of 23,000 barrels capacity was purchased, christened with the name "Cuauhtemoc" under the Mexican flag.

With regard to bottoms for the exportation of petroleum crudes and products, there being no great urgency at that time, the problem was solved by renting some Norwegian tankers, one of which was placed in the service of moving products to the Pacific Coast of Mexico, initiating in this manner the transportation by water of the various products of Pemex, principally of fuel oil and diesel oil.

The administration, which realized from the beginning that maritime transportation gave a better financial return than even crude oil production according to the data of certain oil companies which owned their own tankers, decided upon the purchase of tankers for its own service and bought the diesel-powered "Binta" and "Bisca" of 64,000 barrels capacity each and of Norwegian origin, for $600,000 U. S. each. These boats were renamed the "Cerro Azul" and the "Tapico," and later the "18 de marzo" which had formerly belonged to the Aguila Petroleum Company, was added to the fleet.

A short time later, the volume of exports having increased and it being difficult to purchase vessels because there were none being offered for sale, it was found necessary to hire American and Norwegian tankers to take care of shipments to New York, to Houston and to Havana. The administration also ordered the construction of three 10,500 ton deadweight tankers at the Ansaldo shipyards in Genoa, Italy.

These three boats were especially designed for export service with adequate provisions for the characteristics of the principal Mexican ports, where no more than 30-foot draught could be counted on and no more than 480 feet allowed for maneuvering vessels in turn-arounds.

These tankers were named the "Poza Rica," "Minatitlán" and "Panuco" and were ordered in 1939 at a cost of $1,300,000 U. S. each. They were paid for on a barter basis by Petroleos Mexicanos products, but the administration never got to take possession of them owing to their being interned by the Italian government during the war.

Tankers Seized

At the beginning of the international conflict, various Italian and German vessels were interned in the Mexican ports of Tampico, Coatzacoalcos and Veracruz, among which were 11 tankers which the Mexican government seized in accordance with the practices of international law.

With these vessels, consisting of nine Italian, one German and one French, the tonnage of the Petroleos Mexicanos fleet reached 135,000 tons, and included 15 ocean-going vessels under the Mexican flag. This fleet was able to take care of both coastal and export services effectively.

It was due to this increase in the tonnage of the fleet of Petroleos Mexicanos that the Mexican Republic could contribute so much to the international maritime transport of fuel oil during the war, placing at the disposition of the American War Shipping Administration the following five tankers: "Amatlan," "Faja de Oro," "Juan Casiano," "Tampico," and "Potrero del Llano." Each was of 65,000 barrels capacity.

With the volume of exportations increasing, the administration of Petroleos Mexicanos had to order the purchase of more vessels to meet the requirements of the service, acquiring six American boats which were renamed "Toteco," "Veracruz," "Tamaulipas," "Cacalilao," and "Furbero." These ships continued to navigate under American registry as, when they were purchased, a ruling of the American government was in force prohibiting the changing of the flag of any American vessel while the state of war existed.

To the former vessels, there was later added the American tanker "Aztec," after the war had ended, thus permitting registration under the Mexican flag with the name "Azteca," and the tankers "Toteco" and "Cacalilao" were also then placed under the Mexican flag.

In this manner the fleet of Petroleos Mexicanos reached a total of 21 units with a total capacity of 195,000 tons. War prevented this tonnage from being conserved for any length of time as the submarine campaign had extended to the Atlantic Coast in 1942, causing the loss of several vessels.

The Republic of Mexico contributed with its share of blood and maritime equipment to the triumph of the Allies in the war, suffering the loss of seven tankers torpedoed on the Atlantic Coast with the accompanying loss of 36 mariners among officers and men who died in these accidents.

These extensive losses were a great blow to the administration of Petroleos Mexicanos, not only for the value of the equipment destroyed but also for the confusion suffered in their operations as it became necessary to reorganize the export and coastwise service time and again because of the sinkings.

To these previous losses must be

added that of the tanker "Juan Casiano" through an accident which occurred during October, 1944, in a storm off the Atlantic Coast of the U. S. and also the loss of the "Cuauhtemoc" which was tied up as useless, thus reducing the fleet of Petroleos Mexicanos to 11 tankers with a total capacity of 109,000 tons.

Of these 11 vessels, two are tied up at present, pending repairs or surveys, the "Cerro Azul" and the "Ebano." The others may be divided into two groups, four for the Pacific Coast traffic and five for use on the Atlantic Coast and the Gulf of Mexico.

Exploration Pushed

The administration has formulated a vast plan of exploration and exploitation and preliminary work has been started in various regions of the republic in search of new petroleum reserves and it is believed that production will be increased within a very short time, at least 25 percent over the actual production, which will bring about a proportional increase in domestic distribution as well as in exportation.

According to the recent declarations of President Aleman, exports of Mexican petroleum can constitute a principal source of dollar income as silver did in other epochs before the world-wide fall in price of the white metal. This means that the policy of increasing exports will be followed and it therefore follows that the fleet of Petroleos Mexicanos must be increased proportionately, although, for the present, foreign tankers must go to Mexico.

The administration, foreseeing the necessity of additional maritime transport in the very near future, has planned the purchase of one or two tankers or the renting of those that will be needed and the management has ordered that necessary repairs will be completed immediately on all of the vessels of the fleet to fit them for service.

These repairs represent a considerable outlay as the majority of the ships are more than 20 years old and require important repairs to their hulls as well as to their mechanical equipment before they can be considered fit to pass inspection.

At present the tanker "Ebano" of 72,000 barrels capacity is at Mobile, Ala., having her machinery overhauled at a cost of more than $200,000 U. S. and a survey is being made of repairs for the "Cerro Azul" which probably will be carried out in the shipyards of Baltimore, Md., at a cost probably double the former amount as this vessel must have extensive repairs made in her machinery as well as to the hull and bulkheads.

In the port of Salina Cruz which has a dry-dock capable of handling ships up to 12,000 tons, repairs will be completed on the "Minatitlan," "Toteco," and "Cacalilao," which are the vessels in the worst conditions on the Pacific Coast; leaving pending for later, the repairing of the "Panuco," "Potrero del Llano" and "18 de marzo," the latter having just arrived at Tampico after delivering a cargo of fuel oil to Italy.

It is possible, therefore, that within about six months all the vessels of Petroleos Mexicanos' fleet will have been completely repaired and will be ready to cooperate with their service in increasing the company's production in accordance with the orders of the management. Meanwhile, the purchase of other tankers or the construction of new units, whichever proves most convenient, will be decided upon. The acquiring of new units may well be possible by means of a credit extended for ten or 15 years, such as that recently concluded by Brazil by which 20 transatlantic vessels will be built in American shipyards to be paid for over a period of 20 years at an interest rate of 4 percent.

This would be the easiest way to modernize the tanker fleet of Petroleos Mexicanos, retiring the antiquated vessels now in service which are uneconomical because of their limited capacity and their slow speeds, and acquiring some six of the splendid modern tankers of more than 100,000 barrels capacity and with speed ratings of 15 to 18 miles per hour, built expressly in accordance with the conditions of Mexican ports. These new vessels, with the same expense for crews and administration as our present ships, would bring a much greater return because of their greater capacity and greater speed, thus effecting an important saving.

It is to be hoped that a better comprehension of the economic importance of a maritime fleet to a producing company like Petroleos Mexicanos will bring about the acquisition of a new modern fleet. Even at a high cost, payment would be within the economic possibilities of the company, for such payments could be spread out over a period of ten years or more; or payments could be made in oil as was done in 1939 when three tankers were ordered to be constructed in the Italian shipyards.

Danish Test Planned

The Danish-American Prospecting Company, which belongs to the Gulf Oil concern, plans to extend its drilling activities to the Isle of Fyn in Denmark. Denmark's oil imports in the first six months of 1947, amounting to 338,000 tons, were slightly above last year's semi-annual rate of 314,000 tons but remained far below the 1938 level of 441,000 tons per half-year.

Peru's Oil Policy

■ CONTINUED FROM PAGE 257

natural decline. Fortunately, last year four of the 29 exploration wells drilled in the Talara area were successful. This will permit us for the time being to maintain our production, but the Government would not fulfill its duty if it were to set aside such an important question as our domestic supply of petroleum products.

Favoritism Denied

For the above reason, I demand that Congress again give serious consideration to the "ad-referendum" Sechura Contract, which has been mistakenly called a contract in favor of International Petroleum Company, whereas the company is but one bidder who would be excluded by any better offer in the public bidding to be opened.

My government believes that faced with the necessity of finding and developing new sources of petroleum production, assuring a balanced economy, meeting the requirements of transport and industry and national defense, the country should not assume the additional risks which are inseparable from the petroleum industry. Therefore the exploration and development of this zone should be undertaken by a company qualified by its technical and financial capacity to see the work through in the shortest possible time with the greatest probability of success. Even if the state or a domestic company possessed the necessary capital to adequately explore this area and would be disposed to risk it, we would still be confronted with two practical problems: (1) to find at the opportune time the necessary foreign exchange in order to acquire indispensable equipment and materials and to hire expert technicians; and (2) to obtain the necessary equipment and materials at such time due to shortages and insufficient production of steel and coal in the U.S. and Europe.

Burmah Two Years Away from Capacity Refining Operations

The Burmah Oil Company is not expected to begin full refining operations for another 2½ years, according to a Reuter report from Rangoon (Burma). In prewar years the annual output of the company's fields was 270 million gallons. It is now producing only sufficient fuel for its immediate needs.

The acting general manager of the company stated recently that the firm had already spent £1,500,000 on rehabilitation work. About 4000 men were employed on reconstruction work in the oil fields at Yenangyaung and a similar number at the refineries at Syriam.

a little AQUAGEL goes a long way

Two or three sacks of Aquagel added to the mud already in use can work wonders in cutting drilling time and troubles in workovers, shot-hole drilling, and cable tool jobs.

The concentrated colloidal material contained in Aquagel will improve all drilling muds. It increases viscosity, lowers water loss, deposits a thin filter cake, eliminates caving, checks loss of circulation, and reduces the possibility of stuck drill pipe. For two decades the oil industry has accepted Aquagel for its efficiency and economy. Aquagel will serve the shallow as well as the deep job.

RECOMMENDED TREATMENTS WITH AQUAGEL*

PROBLEM	TO BE ADDED TO DRILLING MUD		TO BE ADDED TO STRAIGHT WATER	
	POUNDS PER BBL.	PERCENTAGE BY WEIGHT	POUNDS PER BBL.	PERCENTAGE BY WEIGHT
1. To add to clay mud to condition it	3 to 7	1 to 2%		
2. To make straight Aquagel-drilling mud			18 to 22	5 to 6%
3. To stop troublesome caving	9 to 11	2½ to 3½%	18 to 26	5 to 7%
4. To stop bad caving	14 to 18	4 to 5%	25 to 30	7 to 8%
5. To stop loss of circulation	10 to 18	3 to 5%	30 to 37	8 to 10%
6. To use before running casing	3 to 10	1 to 3%	14 to 18	4 to 5%
7. To use in cable tool drilling			1 sack to 5 barrels of water	

*Values given are in the average range. Brackish waters will require greater percentages.

BAROID SALES DIVISION
NATIONAL LEAD COMPANY

LOS ANGELES 12 • TULSA 3 • HOUSTON 2

BAROID PRODUCTS: AQUAGEL
AQUAGEL CEMENT • ANHYDROX
BAROCO • BAROID • FIBERTEX
IMPERMEX • JELFLAKE • MICATEX
SMENTOX • STABILITE • ZEOGEL
TESTING EQUIPMENT • BAROID
WELL LOGGING SERVICE

PATENT LICENSES unrestricted as to sources of supply of materials, but on royalty bases, will be granted to responsible oil companies and others desiring to practice the subject matter of any and/or all of United States Patents Numbers 1,807,-082; 1,991,637; 2,041,086; 2,044,758; 2,064,-936; 2,094,316; 2,119,829; 2,214,366; 2,294,-877; 2,304,256; 2,387,694; 2,393,165 and further improvements thereof. Applications for Licenses should be made to Los Angeles office.

To obtain additional information on how to apply Aquagel to the well or wells in your district, please fill out and mail the form below to Baroid Sales Division, P. O. Box 2558, Terminal Annex, Los Angeles 54, California.

Name_____ Title_____

Company_____

Street or Box_____

City_____ Zone_____ State_____

GEOPHYSICAL EXPLORATION

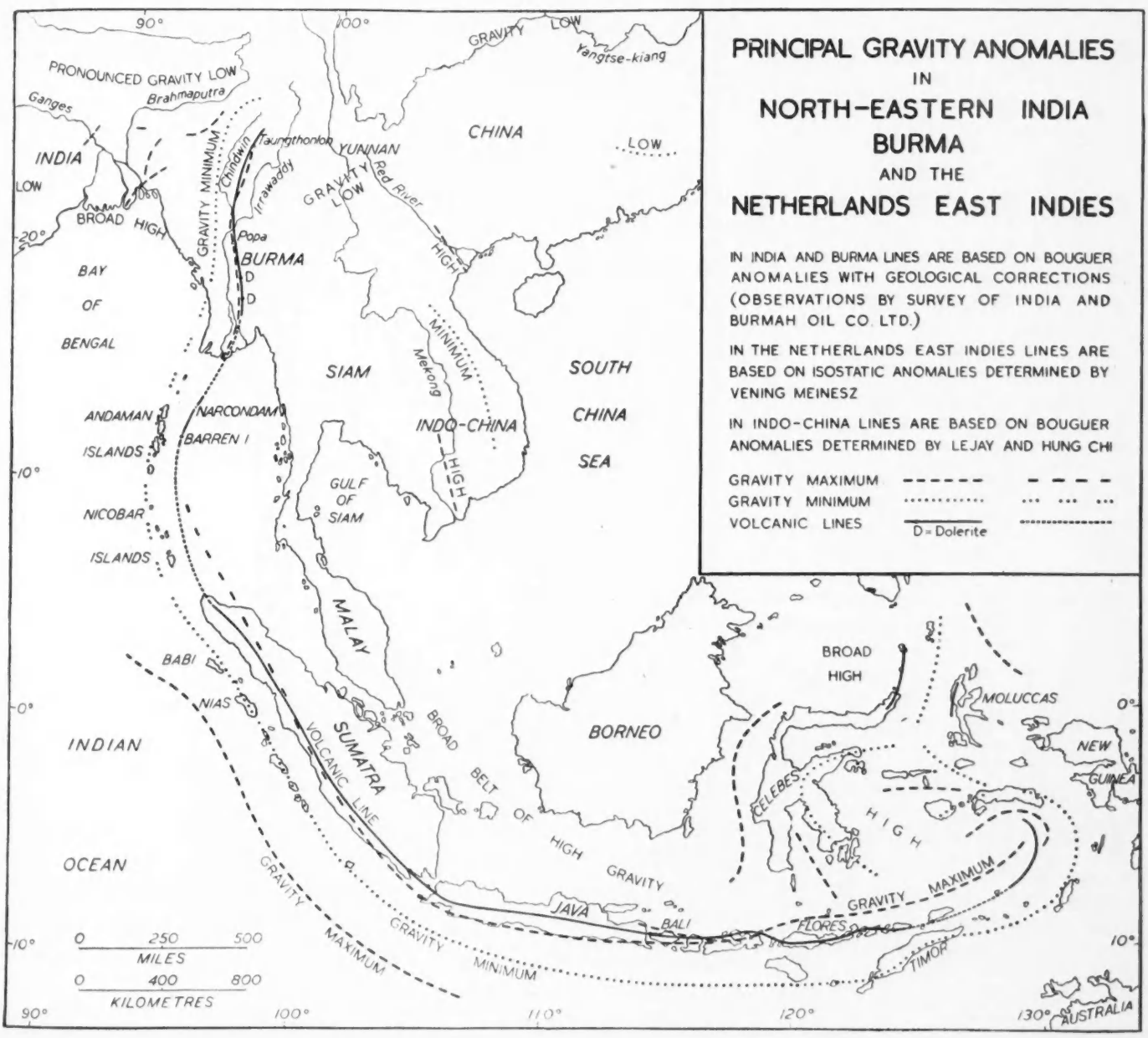
In India

By E. N. TIRATSOO
Special Staff Writer

THE government of Indian recently appointed a Geophysical Planning Committee to work out details of a greatly intensified program to be put into effect in the near future. India is now on the brink of an era of great scientific and technical activity, and it can be expected that much of this activity will be directed to the location of new deposits of economic minerals, particularly petroleum, and that geophysics will play a very large part in these efforts.

As early as the middle of the last century, geodesists and geophysicists obtained data from earth measurements in India on which the Isostatic Theory was based. Calculated plumb-line deflections due to the Himalayas were found to be less than was to be expected from theoretical considerations, and from these results it was deduced that the visible crust is supported on a denser layer and that any excess of mass above the mean surface level must be balanced by a corresponding decrease of mass below. A few years later, Pratt, Hayford and Bowie suggested that instead of higher mountains having deeper roots, there was no variation in the size of the roots but the mountains were compensated by columns of slightly lighter rock extending beneath them to a depth of about 60 miles.

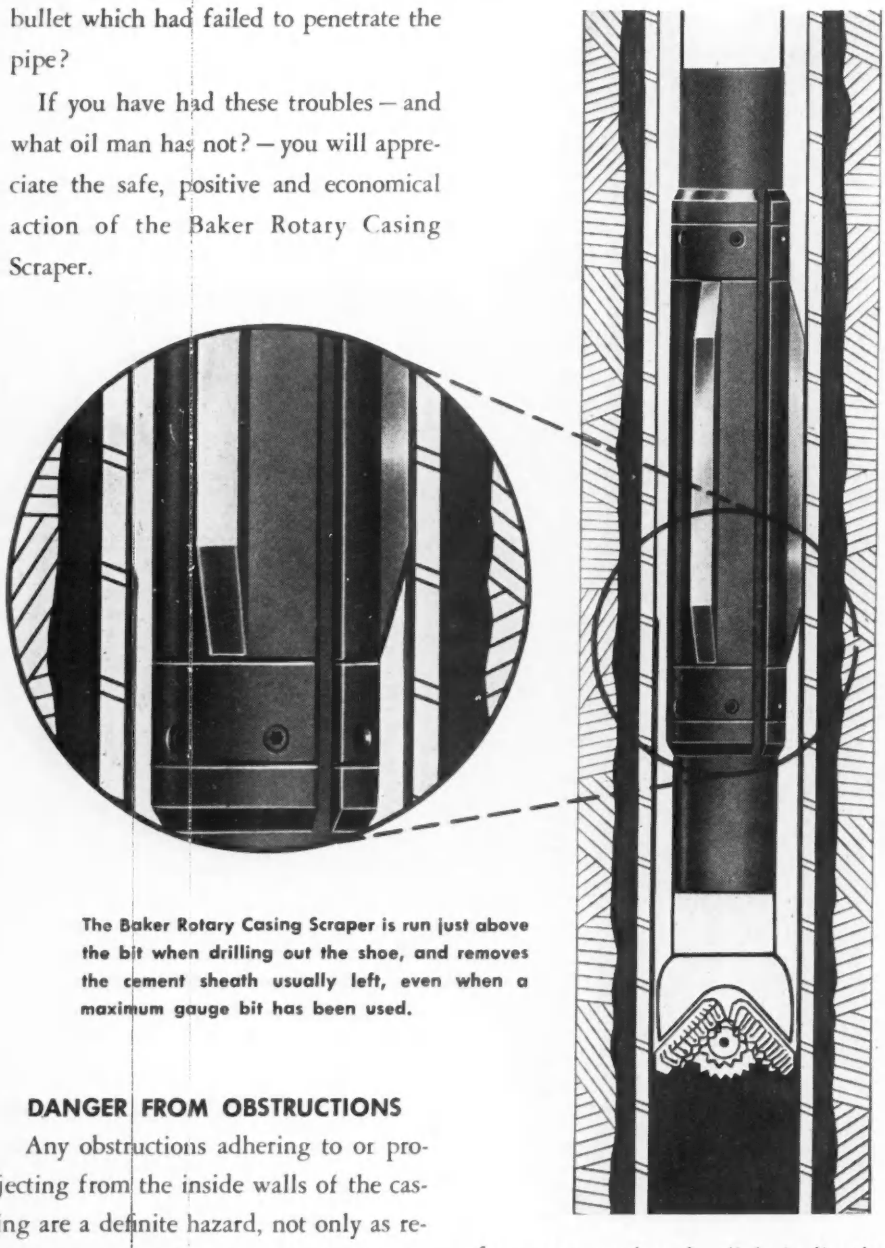
Work done in different parts of the world since these early observations has shown that large parts of the earth's crust are indeed in isostatic equilibrium, but that in other areas, notably in India and in the Netherlands East Indies, there are very striking departures from isostacy. In particular, a narrow strip of strong negative gravity anomalies runs parallel to the west coast of Sumatra, passes through the Nicobar and Andaman islands, which lies to the south



Cleaning Inside Walls of Casing

Have you ever wondered why the slips on a cement retainer or a packer would not set against the casing? Or had swab rubbers quickly torn and mutilated so badly that they were not effective? Did you ever try to run-in a liner or a string of tubing which would always hang up at the same point on a gun perforator bullet which had failed to penetrate the pipe?

If you have had these troubles – and what oil man has not? – you will appreciate the safe, positive and economical action of the Baker Rotary Casing Scraper.



The Baker Rotary Casing Scraper is run just above the bit when drilling out the shoe, and removes the cement sheath usually left, even when a maximum gauge bit has been used.

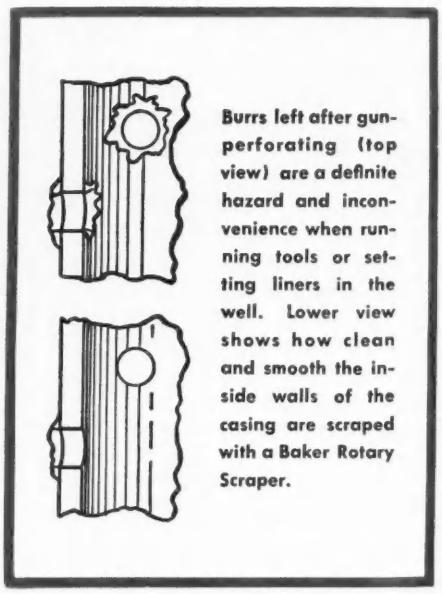
DANGER FROM OBSTRUCTIONS

Any obstructions adhering to or projecting from the inside walls of the casing are a definite hazard, not only as regards the immediate completion of the well, but for the future when the well is placed on the pump, or when work-over or remedial operations are necessary. There is frequently close clearance between the outside diameter of down-hole equipment and the inside diameter of the casing through which such tools are run. Any incrustations or projections on the inside walls of the casing are apt to cause premature setting or damage to the tool. Even when the clearance appears to be ample, the packing elements of cement retainers, packers and swabs often are gouged, and a slight inclination of the hole naturally tends to increase the hazard and inconvenience.

After cementing, it is probable that a hard cement sheath will remain on the inside of the casing, even though a maximum gauge bit has been used to drill out the shoe joint; see illustration and enlarged sectional view. This relatively thin sheath causes the slips of various tools to become filled and packed with cement when an attempt is made to set them, and not only may the slips fail to hold, but often the wickers do not even reach the metal of the pipe. Burrs from gun perforating jobs, bullets that failed to penetrate the casing, as well as paraffin, hardened rotary mud and even mill scale all contribute to the dangers, inconvenience and unnecessary expense when future down-the-hole work must be performed.

CASING EASILY CLEANED

With the Baker Rotary Casing Scraper (Product No. 620) it is a simple and economical operation to scrape the inside walls of the casing, removing *all* obstructions and leaving a surface even smoother and cleaner than when the casing left the mill. The ideal method of running the Baker Casing Scraper is just above the bit when the cement shoe is being drilled out, and before any tools, equipment or subsequent strings of pipe are run.



Burrs left after gun-perforating (top view) are a definite hazard and inconvenience when running tools or setting liners in the well. Lower view shows how clean and smooth the inside walls of the casing are scraped with a Baker Rotary Scraper.

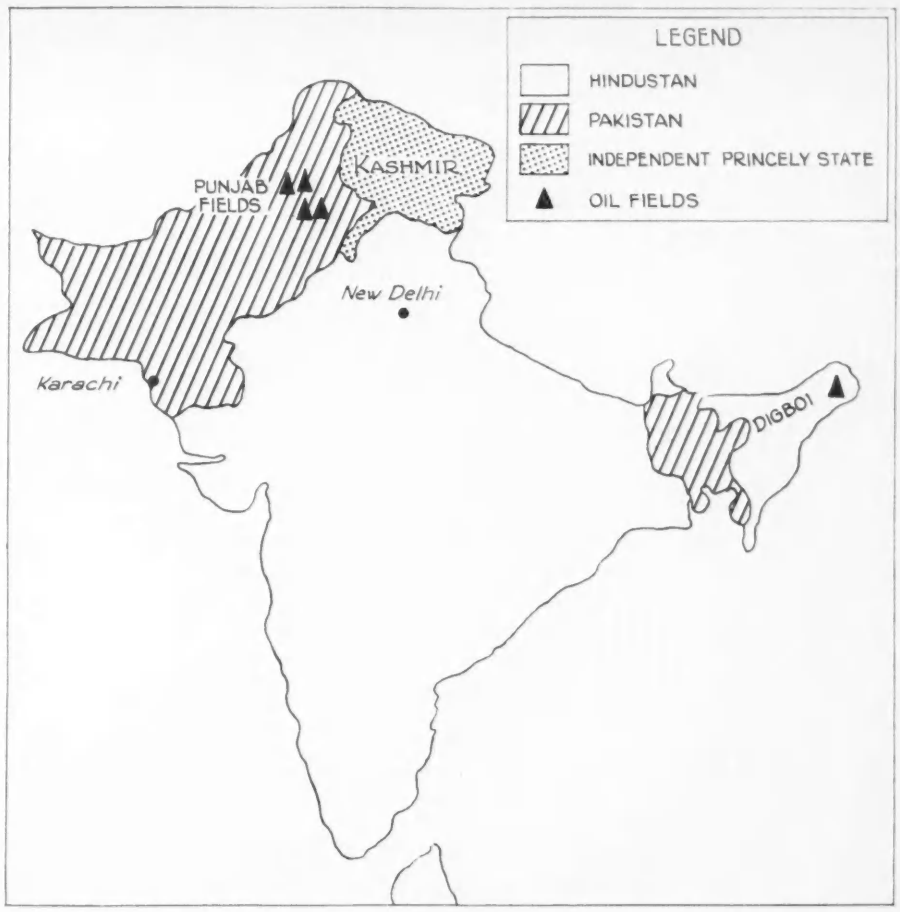
of India, and then links up with a line of negative troughs through west Burma and the fore deep of the Himalayas, and continues into Russian Turkestan, marking a definite tectonic line of earth weakness and structural instability.

The application in India of economic geophysics as opposed to geodetic geophysics, has previously been rather neglected. The Punjab Irrigation Research Institute did some work with the Eótvós torsion balance in the districts of Shahpur and Lyallpur to ascertain the thicknesses of alluvium, and the Mysore State Geological Department has carried out electrical surveys for estimating water-table depths and locating ore deposits. The Survey of India, working in cooperation with the Geological Survey, located a manganese reef in Nagpur with a gradiometer, and prospected by electrical methods for mica-bearing pegmatities in Behar. By far the most work has been carried out by the oil companies, who have covered a large area of India with a well-integrated series of gravity surveys.

The most remarkable contribution made by the oil companies to the geophysical exploration of India has been that of Burma Oil Company which, in an extensive gravity survey of Burma and northeastern India, determined the gravity anomalies at more than 6000 stations, which are ten times the whole number of stations previously available in India. For the first time an effort was made to resolve each of the anomalies into the portion due to known geological causes and the residual portions due to deep-seated variations in rock density. There were many difficulties in determining the geological correction factor, particularly where a thin layer of sediments overlay the metamorphic basement or in alluvial areas, but a method was devised by which reasonably accurate estimates of this correction could be made. Since the investigation was primarily with areas of thick Teritary sedimentation, which might be expected to contain oil accumulations, it was necessary to allow for the gravitational effects of these beds down to a depth of about 40,000 feet.

In the area of Assam and Burma investigated, there were already 140 Surveys of India pendulum stations, and to these the Burma Oil added over 6000 other gravity stations measured by either Holweck, Eising or Thyssen gravimeters, or by the torsion balance.

The results of these investigations have clearly shown that before the significance of gravity data can be properly appreciated, allowance must be made for the effects of density variations in the rocks near the surface, particularly in areas of large sedimentary thickness.



Oil

IN THE NEW INDIA

THE division of India into two dominions will have obvious repercussions on the oil industry in that country. British India, although producing appreciable quantities of indigenous oil, has always had to rely on imports for the greater part of her supplies.

Until 1942, Burma provided about one-half of India's oil imports but since that time Iran has been the principal source, and it seems unlikely that imports from Burma or the Netherlands East Indies will be available in any quantity in the immediate future.

India's indigenous production of oil is at present about 2,100,000 barrels annually, and has been showing a declining trend for several years. The division and distribution of this oil between the two dominions will require a large extent of mutual cooperation. The major oil-producing area is at Digboi in the northeast corner of Assam, which is operated by the Assam Oil Company, a Burmah Oil subsidiary. The fields here lie within an Indian area, but their principal market is in the Pakistan province of Eastern Bengal; and in any case the distribution of Digboi oil to the main industrial centers of India must depend upon the acquiescence of Pakistan to transportation and pipe line arrangements.

The second oil-producing area is in the Pakistan part of the Punjab and is operated by Attock Oil Company. The overall production of these fields has been steadily declining, although hopes are entertained that newly discovered anticlines such as Joya Mair and Balkassar may prove fruitful.

The average consumption of petroleum products per capita in India has never exceeded 1½ gallons per annum. It is probable that when the temporary dislocation caused by the changeover in political control has subsided, an increase in industrial capacity will result in a greatly increased demand for oil in both the dominions. This will result in increased imports as well as accelerated exploration, and the dominion of Pakistan has already announced an extensive programme of geological prospecting for oil and other minerals.

Russia Ready to Set Up Soviet-Persian Oil Firm Under Terms of 1946 Treaty

The Soviet Ambassador in Persia has handed to Qavam Es Sultaneh the Persian Prime Minister, a draft agreement on the formation of a joint Soviet-Persian oil company, in conformity with the Soviet-Persian Oil Treaty of April 4, 1946, it was reported from Moscow.

It was recently reported that Sadchikov, the Soviet Ambassador, who on August 10 returned to Teheran from Moscow after being away since May, intended to ask Qavam to seek parliamentary approval for the formation of a joint oil company.

According to the text of the agreement published in April, 1946, the proposed company was to have a life of 50 years, with Russia providing all the machinery, prospecting and operating expenses and Persia sharing profits as well as retaining title to the land. The Persian government would not cede territory to any other foreign company.

The western limit for research for the Russian-Persian company would be a line starting from the meeting point of the Russian-Turkish and Persian frontiers in the north, running to the eastern shores of Lake Rezaieh (also known as Lake Urumiya).

The ban on cession of territory to foreign companies would apply to the strip of territory bordering the Iraq frontier.

The Soviet request for an oil concession was first reported in October, 1944, when the Persian government declined to take any decision until the war ended. Then, in April, 1946, during the U.N. Security Council debate on the withdrawal of Soviet troops from Persia, the Soviet government and Qavam Es Sultaneh directly negotiated a draft agreement. The Soviet troops were to withdraw, and an agreement for the creation of a joint Persian-Soviet oil company was to be presented to the Majlis within seven months from March 24, 1946. According to this draft agreement, the Soviet government would have held 51 percent of the shares of the company . . . a proportion which might have been revised after 25 years.

There is a growing feeling in Teheran that any future oil developments in Persia should be on an international basis, with Persia holding the majority of the shares and no one power holding more than 15 percent. It is considered that all other forms of agreement entail an interference in the internal affairs of the country.

The Persian government resigned at the end of August in accordance with constitutional requirements, and the new prime minister will now be chosen by agreement between the Shah and the Majlis Qavam Es Sultaneh is likely to be reappointed.

A recent article in Pravda attacking both the Shah and Qavam Es Sultaneh has strengthened Persian determination not to be threatened or stampeded into granting an oil concession on unsatisfactory terms.

Drilling to Be Resumed Soon on Qatar Peninsula

The Qatar Peninsula, known to be another potentially important oil-bearing territory in the Persian Gulf area, is now opened for actual production. Petroleum Development (Qatar) Ltd., a company owned by the same groups as are participating in Iraq Petroleum Company, is about to resume its drilling work in the Dukhan field where exploration was carried on before and in the early stages of the war.

Of the three test wells which were then completed, two struck oil, giving a daily potential yield of approximately 5000 barrels each and proving the existence of a highly promising reserve. Soon afterwards, however, it was found necessary to discontinue drilling and to plug the wells as the danger of over-running by the Nazis was drawing near.

Since it may be impracticable to reopen the two productive wells, drilling will have to be started afresh and a number of wells will have to be drilled to study the geological formations and ascertain the potentialities of the producing area. A 50-mile pipe line must be laid to transport the oil from Dukhan to a suitable deep-water terminal on the Gulf. Commercial shipments are not expected to begin until 1950.

British Gasoline Rationing Back at Wartime Severity

Gasoline rationing in the United Kingdom returned to wartime severity October 1 and no gasoline will be available except for officially-approved trips.

The government had previously announced its intention of reducing the basic petrol ration by one-third in October, but the rapidly deteriorating economic situation has caused total abolition. It is expected that these steps will result in an annual saving of £5 million a year in petrol imports as well as a number of important indirect economies. Foreign visitors still will be able to obtain gasoline for one return journey between the port of arrival and their farthest destination.

The Minister of Fuel and Power has announced that arrangements are being made to dissolve the Petroleum Board December 31. The agreement under which the board was established provided for dissolution not more than two years after the state of emergency ended.

Control of pieces and of imports must remain for the time being, and at the instance of the Minister two committees will be set up by the oil industry through which the government will be able to obtain any information it may require and secure the cooperation of the oil industry in making any arrangements needed to safeguard the national interest. One committee will deal with the supply, refining, and distribution of oil in the United Kingdom, the other with oil questions in general.

The Minister also proposes to set up a consumers' council to advise him on questions relating to the use of oil in the United Kingdom. It will have an independent chairman appointed by the Minister and, apart from the representatives of the oil industry, will include representatives of consumers, of manufacturers of motor cars, motorcycles and other oil-using equipment, and of the Trades Union Council.

Czechs Planning More Use of Baltic Ports for Shipments

Czechoslovakia is making plans for a wider use of the Baltic ports for oil transport, to the detriment of Hamburg. Some oil imports into Czechoslovakia probably will be directed by Italian harbors as a result of the agreement recently signed between Czechoslovakia and Italy. Trieste appears to have lost favor for oil importation, although since the war it has handled considerable quantities of both UNRRA and commercial oil for Czechoslovakia.

Repair work on the petroleum installations in Fiume harbor, now in Yugoslavia has been successfully completed and it is reported that Yugoslavia has offered Czechoslovakia particularly favorable tariff for importing oil via Fiume instead of via Trieste, as previously.

Exploration Planned

D'Arcy Exploration Company (Anglo-Iranian) has been granted two prospecting licenses in England. The first covers 104 square miles in the county of Nottingham, in an area which surrounds the original Eakring licenses which was the site of the first productive British oil field.

The second area consists of 174 square miles in the counties of Hampshire and Sussex, and is identical with the area first licensed to D'Arcy in 1935.

WEST TEXAS - NEW MEXICO PERMIAN BASIN OIL FIELDS

Geological Data, Development History

Compiled by H. H. KING and GILBERT M. WILSON

Acknowledgment for aid in compiling the data in this article is made to the Oil and Gas Division, Texas Railroad Commission, at Austin, Midland and San Angelo, Texas; the Lea County Operators Committee, Hobbs, N. M.; North Basin Pools Engineering Committee, Midland; Goldsmith Pool Engineering Committee, Midland Fullerton Field Engineering Committee, Midland; Berte R. Haigh, University Lands, Midland; H. Smith Clark, consulting geologist, Fort Worth; Southwest Mapping Company, Fort Worth; and various other companies, engineers and geologists.

WEST TEXAS

ANDREWS

BEDFORD

Discovery Data: Seismograph. **Discovery Well:** Shell-Texas' Ratliff-Bedford 1, C NW NE PSL 4, Blk 73, completed November 1, 1945, as dual producer. **Type of Structure:** Anticline. **Producing Formations:** Devonian 8770 to 9292 ft; 5 wells, averaging 351 ft. pay. Ellenburger 11,320 ft; 4 wells, averaging 231 ft. pay. **Producing Area:** Devonian-developed: 400 acres. Ellenbruger-developed: 320 acres. **Production June 30, 1947:** Daily: Devonian 720 bbls; Ellenburger, 720 bbls; total 1440 bbls. (base allowable) **Cumulative:** Devonian 213,542 bbls.; Ellenburger 252,562 bbls. Estimated remaining reserves: Devonian 4,586,000 bbls.; Ellenburger 4,547,500 bbls. **Producing Wells June 30, 1947:** Total 5 (4 dual); flowing 5; artificial lift: none. **Gravity:** Devonian 41.4-42.9; Ellenburger 43.9-44.6. **Rigs Running June 30, 1947:** 2. **Deepest Test:** Shell-Texas' Ratliff-Bedford 3, north outpost and failure in Ellenburger, plugged back from 11,670 ft. **Oil Outlets:** Texas-New Mexico. **Principal Leaseholders:** Discoverers control field. **Remarks:** Commercial production also indicated in Wolfcamp and Silurian. Most easterly well and nearest to outlying failure occupies highest structural position. Ellenburger low and barren in most northerly well.

BLOCK 12

Discovery Data: Geology. **Discovery Well:** The Texas Co.'s University-Atlantic 1-P, C SW NW Sect. 15, Blk. 12, completed August 4, 1946, as Clear Fork discovery. The Atlantic Ref. Co.'s University-Texu 1-E, C NE NE Sect. 18, Blk. 12, completed Jan. 21, 1947, as discovery for Devonian. The Texas Co.'s University 2-T, C NE SE Sect. 22, Blk. 12, completed November 4, 1946, as gasser in Yates. **Type of Structure:** Anticline. **Producing Formations:** Clear Fork 6950-7330 feet; 30 wells, averaging 169 ft. broken pay. Devonian 8454-70 ft.; 1 well, with 116 ft. broken pay. Yates (gas) 2799 to 2950 ft.; 1 well, with 151 ft. broken pay. **Producing Area:** Developed: Clear Fork, 1200 acres; Devonian, 40 acres; Yates (gas) 40 acres. **Production June 30, 1947:** Daily: Clear Fork 3300 bbls.; Devonian 30 bbls. (base allowable); Cumulative: Clear Fork 197,222 bbls.; Devonian, 525 bbls. Estimated remaining reserves: Clear Fork 7,003,000 bbls.; Devonian (negligible). **Producing Wells June 30, 1947:** Total: Clear Fork, 11 flowing; 19 pump. Devonian, none flowing, 1 pump. **Gravity:** Clear Fork, 31 to 37.6; Devonian, 39. **Rigs Runnings June 30, 1947:** None. **Deepest Test:** Atlantic et al's University-Texu 1-A, preceded discovery but within Clear Fork producing area, failure in Ellenburger at 10,575-760 feet. **Oil Outlets:** Texas-New Mexico. **Principal Leaseholders:** Atlantic, Superior, Texas. **Remarks:** Lease expirations forced the staging of large development program when commercial production assured, thus accounting for groups of wells in marginal producing sectors. Average crude yield per acre below par for this depth. Devonian producer does not warrant offsets. Ellenburger production remains a prospective source of production in the face of single failure for this zone.

CLABBERHILL

Discovery Data: Geophysics. **Discovery Well:** Skelly's University 1-K, C SW SW Sect. 28, Blk 9, completed July 28, 1943. **Type of Structure:** Anticline. **Producing Formations:** Glorietta (Holt) lime 5310-550 ft., averaging 57 ft. broken pay. **Producing Area:** Developed, 80 acres. **Production June 30, 1947:** Daily: 100 bbls. Cucumlative: 106,703 bbls. Estimated remaining reserves: 293,000 bbls. **Producing Wells June 30, 1947:** Total: 2 (pumping). **Gravity:** 33.3. **Rigs Running** June 30, 1947: None. **Deepest Test:** Discovery plugged back from barren Clear Fork at 7500 ft. **Oil Outlets:** Humble. **Principal Leaseholders:** Skelly and Texas. **Remarks:** Wells 2 miles apart, with 2 offset failures each; involve separate "highs," but prorated as unit for convenience. Further development questionab'

DEEP ROCK

Discovery Data: Geology. **Discovery Well:** Tripplehorn Bros. (was Deep Rock Oil Co.-Atlantic & California Co.'s) C. E. Ogden 1, SW SW SEP SL Sect 6, Blk A-46, December 18, 1929. Texas' Pattillos 1, C SW SW PSL 22, Blk. A-36, completed May 31, 1944, as oil discovery of Shafter Lake sector and classified as Deep Rock field. **Type of Structure:** Anticline. **Producing Formations:** San Andres (Perm) lime 4280-500 ft.; average penertation, 60 ft. **Producing Area:** Developed: 840 acres. **Production June 30, 1947:** Daily: 159 bbls. Cumulative: 1,029,952 bbls. Estimated remaining reserves: 343,000 bbls. **Producing Wells June 30, 1947:** Total: 19; flowing, 4; artificial lift, 15. **Gravity:** 26-35. **Rigs Running June 30, 1947:** 2. **Deepest Test:** Humble's Carter 1, C SE SW PSL 23, Blk. A-46, failure in Ordovician at 11,812 ft. **Oil Outlets:** Humble. **Principal Leaseholders:** Tripplehorn Bros., Texas, Seaboard, Lario Oil and Gas. **Remarks:** Field includes isolated semi-wildcat to southwest and scattered well in Shafter Lake sector, which will more than double total producers. Original owners of discovery block disposed of their heldings due to small production and inability to gain pipe line connection in view of oil's sulfur content.

DOLLAR HIDE

Discovery Data: Geology-geophysics. **Discovery Well:** Magnolia Pet. Co.-Humble's E. P. Cowden 1, C NW SE PSL 7, Blk. A-55, completed August 23, 1945, from Devonian. Magnolia's Cowden 2-B, C SW SE PSL 4, Blk. A-65, completed January 12, 1947 as dicovery of Silurian oil zone. **Type of Structure:** Anticline. **Producing Formations:** Devonian, 7611-8152 ft.; 13 wells, averaging 90 ft. pay. Silurian, 8345-65 ft; 1 well, 20 ft open hole. **Producing Area:** Developed: Devonian, 520 acres; Silurian, 40 acres. **Production June 30, 1947:** Daily: Devonian, 1988 bbls.; Silurian, 180 bbls. (base allowable). Cumulative: Devonian, 319,888 bbls.; Silurian, 30,977 bbls. Estimated remaining reserves: Devonian 4,-880,000 bbls.; Silurian, 209,000 bbls. **Producing Wells June 30, 1947:** Total: 14 (flowing). **Gravity:** Devonian, 38.2 to 41; Silurian, 43.6. **Rigs Running June 30, 1947:** 7. **Deepest Test:** Humble's Cowden 1, southeast outpost and failure in Devonian at 10,574-737 ft. **Oil Outlets:** Texas-New Mexico. **Principal Leaseholders:** Humble, Lion, Magnolia, Pure, Skelly, Union. **Remarks:** Commercial oil production in the 6700-ft. Wichita-Albany lime passed up in north portion of structure which also will produce from Ellenburger near apex. Productive limits of Devonian virtually defined by low wells and failures to southeast, south and west.

EMBAR

Discovery Data: Geology, geophysics and core drill. **Discovery Well:** Phillips Pet. Co.'s F. Cowden-Embar 1, 660 ft. S of SL Sect. 31, Blk. 10, and 660 ft. E of WL and in T&P Ry. 5, Blk. 44, T-2-N, completed Oct. 25, 1940, as gasser 4146-240 ft.; DD for failure in Ellenburger and recomplete Nov. 1, 1943, as Clear Fork prod. Phillips' University-Andrews 2, C SW SE Sect. 30, Blk. 10, completed May 14, 1942, as Ellenburger-pay discovery; Phillips' University-Andrews 9, C NW NW Sect. 32, Blk. 10, completed Oct. 21, 1942, as Clear Fork-pay discovery. **Type of Structure:** Anticline. **Producing Formations:** Ellenburger, 7750-8014 ft.; 24 wells (with 3 dual), averaging 34 ft. of exposed pay. Clear Fork, 6175 to 6280 ft.; 14 wells (with 3 dual), ayeraging 56 ft of exposed pay. **Producing Area:** (Developed); Ellenburger (80-acre units), 1920 acres; Clear Fork (80-acre units), 1120 acres. **Production June 30, 1947:** Daily: Ellenburger, 6269 bbls.; Clear Fork, 894 bbls. (base allowable). Cumulative: Ellenburger, 4,733,059 bbls.; Clear Fork, 1,155,187 bbls. Estimated remaining reserves: Ellenburger, 10,627,000 bbls; Clear Fork, 5,565,000 bbls. **Producing Wells June 30, 1947:** Ellenburger, 24 flowing; Clear Fork, 11 flowing, 3 pumping. **Gravity:** Ellenburger, 43.9 to 47.5; Clear Fork, 40 to 43.5. **Rigs Running June 30, 1947:** None. **Deepest Test:** Discovery gasser (Permian) DD and PB from Ellenburger 8553-576 ft. **Oil Outlets:** Standish. **Principal Leaseholders:** Phillips. **Remarks:** Minimum of 80-acre spacing permitted due to distress on crude market during development. Dual completion in Permian Basin originated in this field. Productive area defined by failures and low wells; more drilling of inside Ellenburger locations probable in view of wide spacing.

EMMA

Discovery Data: Subsurface and geophysical. **Discovery Well:** Sinclair Prairie Oil Co.'s Emma Cowden 1, near CS½ SE SE 12, Blk. 44, T&P Ry. Sur., March 4, 1937. **Type of Structure: Anticline.** Producing Formations: San Andres lime 4140-500, average 60 ft. penetration. **Producing Area:** Developed, 1520 acres. **Production June 30, 1947:** Daily: 3233 bbls. (base allowable). Cumulative: 4,629,687 bbls. Estimated remaining reserves: 8,520,000 bbls. **Producing Wells June 30, 1947:** Total: 76; flowing, 4; artificial lift, 72. **Gravity:** 34-36. **Rigs Running June 30, 1947:** None. **Deepest Test:** Stanolind's University 1-F, SE SE SW Sect. 25, Blk. 10, failure in Clear Fork at 5585-619 ft. **Oil Outlets:** Humble. **Principal Leaseholders:** Anderson-Prichard; General American; G. E. Hall, Special; Montecito Oil; Sinclair; Skelly; Superior; Texas Co. **Remarks:** Only small percentage of wells have declined to marginal basis. Close spacing arose through the presence of a vacancy strip through heart of the field. Producing area subject to enlargement, and additional drilling justified in view of sustained production.

FUHRMAN-MASCHO

Discovery Data: Trend drilling. **Discovery Well:** Fuhrman Petroleum Corp.'s Ford 1, 440 ft. n and 220 ft. e of sw c PSL Sect. 16, Blk. A-43, Nov. 21, 1930. **Type of Structure:** Anticline. **Producing Formations:** San Andres (Perm) limestone 4200-500 ft. average 140 ft. penetration. **Producing Area:** Developed, 8600 acres. **Production June 30, 1947:** Daily: 3713 bbls. Cumulative: 8,147,048 bbls. Estimated remaining reserves: 43,453,000 bbls. **Producing Wells June 30, 1947:** Total: 209; flowing, 52; artificial lift, 157. **Gravity:** 26-31. **Rigs Running June 30, 1947:** 3. **Deepest Test:** Magnolia's Univ. 1-15 c ne se Sect. 15, Blk. 10, situated in field proper, failure in Clear Fork at 7627 ft. **Oil Outlets:** Humble. **Principal Leaseholders:** Cities Service, Fuhrman, Gulf,

N. G. Penrose, Phillips, Seaboard, Shell, Standard of Texas, Stanolind, Superior. **Remarks:** Discovery sector of field is most productive, and warrants further development. Wide spacing of wells generally adhered to in less productive sectors to the west and south.

FUHRMAN-MASCHO ELLENBURGER

Discovery Data: Geology-geophysics. **Discovery Well:** Placid Oil Co.-Gulf's Thornberry 1, C SW SW PSL 5, Blk. A-42, completed Sept. 10, 1946. **Type of Structure:** Anticline. **Producing Formations:** Ellenburger at 11,941-55 ft. involving 14 ft. of dolomite pay. **Producing Area:** 40 acres. **Production June 30, 1947:** Daily: 2 bbls. Cumulative: 4,303 bbls. Estimated remaining reserves: Unimportant. **Producing Wells June 30, 1947:** Total: 1 (pumper). **Gravity:** 40.2. **Rigs Running June 30, 1947:** None. **Deepest Test:** Discovery drilled to water at 11,959 ft. **Oil Outlets:** Humble. **Principal Leaseholders:** Discoverers, Stanolind, Tide Water. **Remarks:** Deepest producer in district. Combination of abundance of water, small crude yield and thin pay at great depth discourages further development. Discovery will be abandoned.

FULLERTON "8500"
AREA 1

Discovery Data: Geology-geophysics. **Discovery Well:** Mid-Continent Pet. Corp.'s University 1, Lse. 7, C SW SE Sect. 20, Blk. 13, completed August 22, 1944, as Devonian-pay discovery; Mid-Continent's University 3-11, C NW NE Sect. 29, Blk. 13, completed Jan. 2, 1946, as Ellenburger-pay discovery; Mid-Continent's University 8-11, completed Sept. 19, 1946, as Glorietta (Holt)-pay discovery. **Type of Structure:** Anticline. **Producing Formations:** Devonian, 8375-697 ft.; 36 wells, averaging 93 ft. pay. Ellenburger, 10,596-630 ft.; 1 well with 34 ft. pay. Glorietta, 6070-120 ft.; 1 well, with 50 ft. broken pay. **Producing Area:** Developed-Devonian, 1440 acres and proved undrilled, possibly 160 acres. Developed-Ellenburger, 40 acres; Glorietta, 40 acres. **Production June 30, 1947:** Daily: Devonian, 4776 bbls.; Ellenburger, 220 bbls; Glorietta (idle) (base allowable). Cumulative: Devonian, 1,569,853 bbls; Ellenburger, 120,347 bbls; Glorietta, 481 bbls. Estimated remaining reserves: Devonian, 15,710,000 bbls; Ellenburger, 480,000 bbls; Glorietta (inactive due to sour crude). **Producing Wells June 30, 1947:** Total: Devonian, 35 (flowing, 33; artificial lift, 2 and 1 abnd.); Ellenburger, 1 (flowing); Glorietta, 1 (pumper). **Gravity:** Devonian, 40 to 44; Ellenburger, 40; Glorietta, 36. **Rigs Running June 30, 1947:** Devonian, 1; Ellenburger and Glorietta, none. **Deepest Test:** Ellenburger-pay discovery, PB from 10,696 ft. in water. **Oil Outlets:** Magnolia-Standish, Stanolind pending. **Principal Leaseholders:** Mid-Continent and Stanolind. **Remarks:** Clear Fork (7100 ft.) production confined to west edge of Devonian structure and incorporated with Fullerton field. Devonian producing area virtually defined; Ellenburger producing area due to be small when fully explored.

FULLERTON "8500"
AREA 2

Discovery Data: Geology-Geophysics. **Discovery Well:** Mid-Continent's University 1, Lse. 15, C NE NW Sect. 42, Blk. 13, completed December 3, 1945. **Type of Structure:** Anticline. **Producing Formations:** Devonian 8355-790 ft., averaging 139 ft. pay. **Producing Area:** Developed, 840 acres; proved, 1080 acres. **Production June 30, 1947:** Daily, 2720 bbls. (base allowable). Cumulative: 547,324 bbls. Estimated remaining reserves: 9,553,000 bbls. (developed). **Producing Wells June 30, 1947:** Total: 20 (flowing); 1 outpost depleted and plugged back to Clear Fork. **Gravity:** 44 to 46. **Rigs Running June 30, 1947:** 2. **Deepest Test:** Stanolind's Lotus 1-D, C NE NE PSL 24, Blk. A-48, PB from water in Devonian 8760-850 ft. to Clear Fork pay; 2 others same depth, but higher structurally. **Oil Outlets:** Magnolia, Standish, Stanolind pending. **Principal Leaseholders:** Gulf, Mid-Continent, Phillips, Sinclair Prairie, Stanolind. **Remarks:** Prolific Clear Fork (7100 ft.) oil production overlaps the Devonian structure, accounting for twin wells, and thus upper zone classified as extension to original Fullerton field. Stanolind's University 1-P, C NE NE Sect. 44, Blk. 13, 1 1/16 miles southeast outpost, depleted Devonian and recompleted in Clear Fork. Devonian producing area virtually defined.

FULLERTON
(PERMIAN ZONES)

Discovery Data: Geology. **Discovery Wells:** Fullerton Oil Co.'s Wilson 1, NE SW SE PSL 15, Block A-32, completed March 3, 1942, as discovery of field in Clear Fork zone. Fullerton Oil Co.'s Wilson 6-A, C NW NW PSL 16, Blk. A-32, completed June 5, 1943, as discovery of Yates gas zone. Magnolia's Ralph 3-11, 801 ft. out SE C PSL 11, Blk. A-37, completed Dec. 18, 1944, as discovery of Yates oil zone. Chalmette Pet. Corp.'s Lake Shore Corp. 1, C NW NE PSL 24, Blk. A-26, completed May 30, 1945, as discovery of San Andres oil zone. Fullerton's Wilson 124, 1980 ft. EWL and 810 ft. NSL PSL 15, Blk. A-32, completed April 28, 1947, as discovery of Wolfcamp zone. **Type of Structure:** Anticline. **Producing Formations:** Clear Fork, 6650-7381 ft., averaging 253 ft. of broken pay, being 4 layers. Yates (gas), 3093-122 ft., 1 well, involving 19 ft. pay. Yates (oil), 3050-150 ft., 1 well, involving 100 ft. of broken sand. San Andres, 4580-650 ft., 1 well, involving 70 ft. pay. Wolfcamp, 8098-135 ft., 1 well, involving 35 ft. lime pay. **Producing Area:** Clear Fork-Developed, 19,280 acres. **Production June 30, 1947:** Daily: Clear Fork, 27,760 bbls.; Yates, 20 bbls.; San Andres, 14 bbls. and Wolfcamp, 17 bbls. Cumulative: Clear Fork, 24,141,384 bbls.; Yates, 10,471 bbls.; San Andres, 9503 bbls.; Wolfcamp, 1709 bbls. Estimated remaining reserves: Clear Fork, 187,939,000 bbls.; Yates, Wolfcamp and San Andres unimportant. **Producing Wells June 30, 1947:** Total: Clear Fork, 482; flowing, 473; artificial lift, 8; Yates, 1 (pumper); San Andres, 1 (flowing); Wolfcamp, 1 (pumper). **Gravity:** Clear Fork, 39 to 43; Yates, 41; San Andres, 35.2; Wolfcamp, 42.1. **Rigs Running June 30, 1947:** 14. **Deepest Test:** Discussed under Fullerton (pre-Permian). **Oil Outlets:** Magnolia, Standish and Stanolind pending. **Principal Leaseholders:** Anderson-Prichard, Bay, British-American, Champlin, Cities Service, Continental, Frank and Geo. Frankel, Fullerton, Gulf, Humble, Magnolia, Mid-Continent, Ohio, Phillips, Shell, Sinclair, Stanolind, Superior, Texas, T. P. Coal & Oil, Union. **Remarks:** Largest Clear Fork crude reserve in district, with continuous and narrow belt of Clear Fork production extending south from west side of the structure, by passing the Fullerton "8500" (Devonian) Area No. 1 on the west, thence south for undetermined distance, but proved in southeasterly direction across Fullerton "8500" (Devonian) Area No. 2 for several miles. In excess of 100 Clear Fork-zone wells remain to be drilled. Deeper pays discussed under separate headings.

FULLERTON
(PRE-PERMIAN ZONES)

Discovery Data: Geology. **Discovery Well:** Fullerton's Wilson 322-A, 1988 ft. EWL and 1985 ft SNL PSL 16, Blk A-32, completed Dec. 11, 1945, as Ellenburger-pay discovery. Texas Pacific Coal & Oil Co.'s Jackson 14-D, 810 ft. SNL and 660 ft. EWL PSL 17, Blk. A-32, completed June 5, 1947, as discovery of the Devonian oil zone. **Type of Structure:** Anticline. **Producing Formations:** Ellenburger, 9752-045 ft.; 4 wells, averaging 75 ft. dolomite pay. Devonian, 8120-290 ft.; 1 well, involving 4 zone of perforations totalling 100 ft. **Producing Area:** Developed-Ellenburger, 160 acres; proved undrilled 200 acres plus. Developed-Devonian, 40 acres; proved undrilled, 160 acres plus. **Production June 30, 1947:** Daily: Ellenburger, 800 bbls.; Devonian, 180 bbls. Cumulative: Ellenburger, 242,817 bbls.; Devonian, 5642 bbls. Estimated remaining reserves: Ellenburger, 9,357,000 bbls.; Devonian (developed), 474,500 bbls. **Producing Wells June 30, 1947:** Total: Ellenburger, 4 (flowing); Devonian, 1 (flowing). **Gravity:** Ellenburger, 38.6 to 40.6; Devonian, 44. **Rigs Running June 30, 1947:** 3. **Deepest Test:** T. P. Coal & Oil's Jackson 14-D, Devonian-pay discovery, failure in Ellenburger at 10,425-534 ft.; plugged back. **Oil Outlets:** Magnolia, Standish and Stanolind pending. **Principal Leaseholders:** Fullerton, T. P. Coal & Oil. **Remarks:** Ellenburger and Devonian zones register sharp dip to north, northwest and west, with production confined to comparatively small but unusually prolific area. Silurian lime, an intermediate oil zone capable of prolific flow also present at high-point of pre-Permian structure.

MARTIN-SAN ANDRES
(WAS WEST ANDREWS)

Discovery Data: Geology. **Discovery Well:** Atlantic-Helmerich & Payne, Inc.'s University 1, C NE NE Sect. 11, Blk. 11, completed July 6, 1940. **Type of Structure:** Anticline. **Producing Formations:** San Andres 4185 to 4470 ft., averaging 124 feet of broken lime pay. **Producing Area:** Developed, 800 acres (widely scattered). **Production June 30, 1947:** Daily: 83 bbls. Cumulative: 140,600 bbls. Estimated remaining reserves: 99,400 bbls. **Producing Wells June 30, 1947:** Total: 17 (pumpers). **Gravity:** 33 to 38. **Rigs Running June 30, 1947:** None. **Deepest Test:** Stanolind's University 1-W, C SW NW Sect. 19, Blk. 10, failure in Simpson at 8374 feet. **Oil Outlet:** Humble. **Principal Leaseholders:** Atlantic-Helmerich & Payne, Kewanee, Mid-Continent, Phillips. **Remarks:** Originally identified as West Andrews field. Production extends at irregular intervals from south end of Martin field to northwest portion of Embar field. All wells are marginal pumpers; majority not commercial but operated to retain deep rights. Doubtful if development of San Andres will be revived.

MARTIN

Discovery Data: Geology. **Discovery Well:** Sun Oil Company's Martin 1, C SE SE PSL 17, Blk. A-41, completed March 16, 1945, in Wichita-Albany as field discovery. Humble's Parker 1, C NW NE PSL 24, Blk. A-41, completed Nov. 10, 1945, as Simpson (McKee)-pay discovery. Humble's Parker 2, C NW NW PSL 23, Blk. A-41, completed March 15, 1946, as Ellenburger-pay discovery. **Type of Structure:** Anticline. **Producing Formations:** Wichita-Albany (Permian) 6805-7055 ft.; 2 wells averaging 173 ft. pay. McKee (Ordovician) 8690-790 ft.; 2 wells averaging 83 ft. pay. Ellenburger, 8620-960 ft.; 11 wells, averaging 144 ft. pay. **Producing Area:** Developed, Wichita-Albany, 80 acres; McKee, 80 acres; Ellenburger, 440 acres. **Production June 30, 1947:** Daily: Wichita-Albany, 71 bbls.; McKee, 168 bbls.; Ellenburger, 1480 bbls.; Cumulative: Wichita-Albany, 77,729 bbls.; McKee, 37,862 bbls.; Ellenburger, 334,975 bbls. Estimated remaining reserves: Wichita-Albany, 242,000 bbls; McKee, 522,000 bbls.; Ellenburger, 4,945,000 bbls. **Producing Wells June 30, 1947:** Total: Wichita-Albany, 2 (pumpers). McKee, 2 wells, flowing 1, pumping 1. Ellenburger, 11 wells, flowing 7, pumping 4. **Gravity:** Wichita-Albany, 35; McKee, 40-42; Ellenburger, 42-43. **Deepest Test:** Atlantic & Phillips' University 1-B-11, offsetting most southerly Ellenburger producer, 9160 ft. **Oil Outlet:** Humble. **Principal Leaseholders:** Atlantic-Phillips, Humble, Sun, Shell-Superior. **Remarks:** Wichita-Albany and McKee zones confined to the flank of the Ellenburger high. Ellenburger production due to expand north.

MEANS

Discovery Data: Subsurface geology. **Discovery Well:** Humble's R. M. Means 1, near C NE NE 2 PSL Sur., Blkk. A-35, August 6, 1934, as oil discovery. Humble's R. M. Mean's 5, C SW SW PSL 4, Blk. C-45, completed August 6, 1935, as shallow gas-pay discovery. **Type of Structure:** Anticline. **Producing Formations:** San Andres lime 4325-609 ft. averaging 86 feet of broken lime pay. Yates (gas), 2820-3211 ft., averaging 195 feet of broken sand pay. **Producing Area:** Developed, 7360 acres. **Production June 30, 1947:** Daily: 3950 bbls. Cumulative, 11,361,389 bbls. Estimated remaining reserves, 47,519,000 bbls. **Producing Wells June 30, 1947:** Total: 182, flowing, 66; artificial lift, 116. **Gravity:** 28 to 33. **Rigs Running June 30, 1947:** 5. **Deepest Test:** Humble's J. S. Means 88-X, 660 ft. WEL and 760 ft. SNL of PSL 9, Blk A-35, failure in Ellenburger 13,960-14,093 ft., second deepest test in district. **Oil Outlet:** Humble. **Principal Leaseholders:** Humble, Sun, Shell, Snowden, Texas-Pacific, Trinity. **Remarks:** Considerable development pending in northwest extension sector, while inside drilling possible in older producing area. Shallow gas development not important.

MIDLAND FARMS

Discovery Data: Geology. **Discovery Well:** Stanolind's Midland Farms Co. 1-F, C SE NW G&MMB&A 1, Blk. 42, T-2-N, completed June 26, 1944. **Type of Structure:** Anticline. **Producing Formation:** Grayburg, 4645-880 ft., averaging 127 ft. pay. **Producing Area:** Developed, 1280 acres. **Production June 30, 1947:** Daily: 1720 bbls. Cumulative: 1,269,574 bbls. Estimated remaining reserves: 11,530,000 bbls. **Producing Wells June 30, 1947:** Total: 16 (flowing 8, pumping 8). **Gravity:** 30-32. **Rigs Running June 30, 1947:** None. **Deepest Test:** Discovery plugged back from water in San Andres at 4942 ft. **Oil Outlets:** Humble. **Principal Leaseholders:** Stanolind. **Remarks:** No failure within mile of field; developed on 80-acre spacing; more development pending.

NELSON

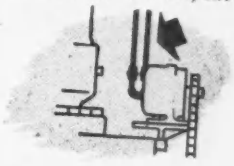
Discovery Data: Geology. **Discovery Well:** Shell's A. Nelson-Humble 1, C NE SE PSL 8, Blk. A-40, completed June 9, 1946. **Type of Structure:** Anticline. **Producing Formations:** Ellenburger 10,384-585 ft., averaging 98 ft. pay. **Producing Area:** Developed, 120 acres. **Production June 30, 1947:** Daily: 660 bbls. Cumulative: 132,219 bbls. Estimated remaining reserves: 1,068,000 bbls. **Producing Wells June 30, 1947:** Total: 3 (flowing). **Gravity:** 42-43. **Rigs Running June 30, 1947:** 2. **Deepest Test:** Humble's Scarborough 1, C SW SE PSL 7, Blk. A-40, failure in granite 10,910-929 ft. that preceded the discovery and provided subsurface for spotting the discovery. **Oil Outlet:** Magnolia. **Principal Leaseholders:** Shell, Humble, Stanolind. **Remarks:** Area includes Humble's Sims 2, situated 3¼ miles NW of discovery and on same producing contour, which was named Freund field then consolidated with Nelson field. Sims 2 passed up prospective oil production at 7300-ft. level in Basal Permian.

PARKER

Discovery Data: Subsurface geology. **Discovery Well:** Honolulu-Woodley's (was Llano's) J. E. Parker 1-A near C SW 7, Blk. A-44, PSL Sur., Dec. 9, 1934. **Type of Structure:** Anticline. **Producing Formation:** San Andres 5615-759 ft., averaging 120 ft. broken pay. **Producing Area:** Developed, 80 acres. **Production June 30, 1947:** Daily: 29 bbls. Cumulative: 132,463 bbls. Estimated remaining reserves: 50,000 bbls. **Producing Wells June 30, 1947:** Total: 2 (pumping). **Gravity:** 32-33. **Rigs Running June 30, 1947:** None. **Deepest Test:** Honolulu-Woodley's Parker 2-B, C SE SE PSL 9, A-43, failure in Clear Fork at 6116 ft. **Oil Outlet:** Humble. **Principal Leaseholders:** Honolulu-Woodley. **Remarks:** Wells are ¾-mile apart; no failures within ¾ mile. More development may occur.

Complete control gate efficiency

4 Check ☑ INSTALLATION SIMPLICITY! *Simple installation requirements save rigging up time, save space and give a cleaner, safer, more efficient cellar.*

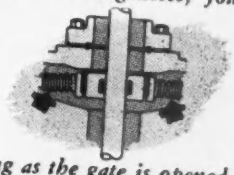


Shaffer Gates are extremely simple to install. Only two quick pipe connections are required for air, hydraulic, or steam drives — just a single electric circuit for the electric motor drive. no cellar-clutter, no complicated piping, no space-wasting manifolding. Yet gate operation is completely centralized through *one* convenient control at the driller's fingertips!

5 Check ☑ EASE OF CHANGING RAMS! *Quick, easy ram changes simplifies changing from one pipe size to another so that complete pressure protection can be maintained.*

Here again it's Shaffer. Just remove *one* end cover and the *complete* ram assembly — not just *half* of it — is readily removable for changing the rams. Change rams, replace one end cover, and the job's done. It's as quick and easy as that!

6 Check ☑ FOOLPROOF RAM POSITIONING! *In the excitement of pressure emergencies, you want a gate you can close — and have it stay closed without auxiliary locking devices or additional operations to remember about.*



Positive screw feed holds Shaffer rams solidly in whatever position they are set *without risk of "creeping."* No locking devices or secondary operations of any kind are needed!

7 Check ☑ NON-DRAGGING RAMS! *Rams in which the sealing surfaces drag as the gate is opened or closed are harder to operate and rapidly lose their sealing efficiency through unnecessary wear on the sealing surfaces.*

Shaffer Gates have patented "floating rams" in which the surfaces that seal between rams and gate body remain retracted until the gate is closed — then expand *automatically* to form a pressure-tight seal. No wear — no drag — and the sealing surface is thus protected against damaging friction!

8 Check ☑ FULL UTILIZATION OF WELL PRESSURE — *both to assist in the closing operation and to increase the sealing efficiency after the rams are closed.*

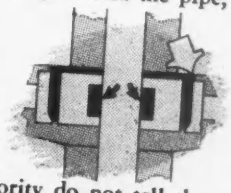
Shaffer Gates are so designed that the well pressure flows below and behind the rams to balance any pressure on the face of the rams, thus insuring pressure-free closing. After the rams are closed, well pressure below the rams assists in sealing them even tighter as pressure increases. The higher the pressure the tighter Shaffer Gates seal — *automatically!*

9 Check ☑ SELF-CLEANING DRAINAGE! *Because of the very nature of drilling operations, mud and sand cannot help but get into a control gate. So look for self-cleaning efficiency that assures free ram travel and smooth operation.*

Note how the entire bottom of Shaffer Gates is sharply sloped toward the well so that any mud and sand that DOES get into the gate quickly drains back out again. The rams travel on high narrow guide ribs that afford adequate support yet prevent mud and sand accumulation from interfering with free ram operation!

10 Check ☑ FOR COMPLETE PRESSURE SEAL! *For full pressure protection make certain that your control gate provides a tight leak-proof seal at all points where leakage might occur.*

Shaffer Gates give a complete pressure seal. When Shaffer Rams are closed, they not only seal against each other and completely around the pipe, but also seal in a complete circle against the upper inside face of the gate body. They not only close and hold against the highest pressures, but will safely hold extremely high pressures *indefinitely* after being closed!



Even these ten points of Shaffer superiority do not tell the *complete* Shaffer story of unequalled efficiency and safety. But they give some idea of the multiple advantages you get in Shaffer Control Gate Equipment. We invite you to check them against all other control gates. Then get the full details from your Shaffer representatives — or write direct.

SHAFFER

HIGH PRESSURE DRILLING AND CONTROL EQUIPMENT • FISHING TOOLS THAT EXCEL

SHAFFER TOOL WORKS, Brea, California • California Service Shops: Santa Fe Springs and Taft
HOUSTON, TEXAS, 6006 Navigation Blvd. • ODESSA, TEXAS, 1925 West Second Street
OKLAHOMA CITY, OKLAHOMA, Acme Oil Tool Company, 1001 S. E. 29th Street
EXPORT SALES OFFICE: Shaffer Tool Works, 30 Rockefeller Plaza, New York, N. Y., U. S. A.

Send for the complete new Shaffer Catalog!

See pages 3454 to 3506 of your 1947 Composite Catalog for helpful information on Shaffer equipment.

PHILRAY

Discovery Data: Geology. **Discovery Well:** Phillips-Sunray's University 1-H, C SW SW Sect. 37, Blk. 9, completed August 10, 1944. **Type of Structure:** Anticline. **Producing Formations:** Grayburg 4504-717 ft., averaging 136 feet broken lime pay. **Producing Area:** 80 acres. **Production June 30, 1947:** Daily: 74 bbls. Cumulative: Included with North Cowden field. Estimated remaining reserves: Included with North Cowden. **Producing Wells June 30, 1947:** Total: 2 (pumping). **Gravity:** 30-32. **Rigs Running June 30, 1947:** None. **Deepest Test:** Phillips-Sunray's University 1-J, C NE NW Sect. 48, Blk. 9, se/o to discovery, failure in San Andres at 4858 ft. **Oil Outlet:** Humble. **Principal Leaseholders:** Discoverers. **Remarks:** Owners surrendered offset leases after 3 failures. Area is 2¼ miles northeast and separated by failures from North Cowden field, but prorated with latter for convenience.

SHAFTER LAKE
(GAS)

Discovery Data: Geology. **Discovery Well:** Texas' University 1-H, NW NE SE Sect. 4, Blk 14, completed December 8, 1938. **Type of Structure:** Anticline. **Producing Formations:** Yates sand 2870-3100 ft., averaging 53 ft. broken gas pay. **Producing Area:** 3520 acres (gas). **Producing Wells June 30, 1947:** Total: 22. **Rigs Running June 30, 1947:** None. **Deepest Test:** Texas' University 1-0, C SE SE Sect. 6, Blk. 14, plugged back from barren Clear Fork at 7844 ft. to gas. **Gas Outlet:** Empire Southern. **Principal Leaseholders:** Andrews Production-Empire Southern, Cities Service, Texas and White Eagle Oil. **Remarks:** Structure rated as deep-production prospect. Gas development on 160-acre units.

THREE BAR

Discovery Data: Geophysics. **Discovery Well:** Stanolind's University 1-D, 2051 ft. EWL and 660 ft. NDL Sect. 8, Blk. 11, completed March 6, 1945. **Type of Structure:** Anticline. **Producing Formations:** Devonian 8080-350 ft. averaging 68 ft. pay. **Producing Area:** Developed, 160 acres. **Production June 30, 1947:** Daily: 552 bbls. Cumulative: 208,782 bbls. Estimated remaining reserves: 1,391,000 bbls. **Producing Wells June 30, 1947:** Total: 4 (flowing). **Gravity:** 41-42. **Rigs Running June 30, 1947:** 1. **Deepest Test:** Discovery plugged back from Ellenburger at 10,057-466 ft. **Oil Outlet:** Humble. **Principal Leaseholders:** Stanolind and Champlin. **Remarks:** Devonian pay will be expanded to 600 acres plus. Clear Fork and Silurian oil production will be developed from portions of structure. Development confined to single well to 320-acre tracts to date, but closer spacing will be required by University.

UNION

Discovery Data: Geology. **Discovery Well:** Union Oil's Biles 1, C NW NE PSL 19, Blk. A-31, completed August 30, 1943. **Type of Structure:** Anticline. **Producing Formations:** Wichita-Albany (Permian) 6840-7500 ft., averaging 477 feet of broken lime pay. **Producing Area:** Developed, 1120 acres: proved undrilled, 400 acres plus. **Production June 30, 1947:** Daily: 1550 bbls. Cumulative: 1,715,115 bbls. Estimated remaining reserves: 7,245,000 bbls. **Producing Wells** June 30, 1947: Total: 25 (flowing, 12: artificial lift, 13: 3 wells dormant). **Gravity:** 41-43. **Rigs Running June 30, 1947:** None. **Deepest Test:** Shell's Scarborough 1-E, 662 ft. NSL and 806 ft. EWL PSL 11, Blk. A-31, failure in granite at 9703-14 ft.; topped barren Ellenburger at 9380 ft. and granite-wash at 9630 ft. **Oil Outlet:** Magnolia. **Principal Leaseholders:** Shell, Union, D. L. Dorland, Lion. **Remarks:** Development of undrilled proved and semi-proved acreage will be on cautious basis due to field advancing into pumping stage.

ANDREWS-MARTIN

MABEE

Discovery Data: Geophysics. **Discovery Well:** The Texas Company's Mabee 1, C NE SW G&MMB&A 37, Blk. 40, completed October 12, 1943. **Type of Structure:** Anticline. **Producing Formations:** Grayburg (Permian) lime 4560-4780 ft., averaging 57 ft., penetration. **Producing Area:** 5000 acres. **Production June 30, 1947:** Daily: 4896 bbls. (base allowable). Cumulative: 2,853,460 bbls. Estimated remaining reserves: 34,650,000 bbls. **Producing Wells June 30, 1947:** Total: 81 (pumping); depleted, 1. **Gravity:** 29-32. **Rigs Running June 30, 1947:** None. **Deepest Test:** Texas' Mabee 9; plugged back from 4807 ft. **Oil Outlets:** Texas-New Mexico. **Principal Leaseholders:** Texas and Mabee Oil & Gas. **Remarks:** Nominal extensions possible.

COCHRAN, HOCKLEY, TERRY AND YOAKUM

SLAUGHTER

Discovery Data: Random drilling. **Discovery Well:** Honolulu Oil-Cascade Pet.-Devonian Oil's Duggan 1, near C Labor 13, League 55, Oldham CSL, Cochran County, completed Oct. 22, 1936, as field discovery and originally called Duggan field. Texas' Slaughter Unit 1, C SW¼ Labor 83, League 38, Oldham CSL, Hockley County, completed April 28, 1937, on 6219-acre unitized lease and 11 miles east nearest production, which later joined T. P. Coal & Oil Co.'s Rucker 1, SEC Lab. 15, Leag. 43, Rains CSL, Hockley County, completed March 10, 1945, as gasser. **Type of Structure:** Monocline. **Producing Formation:** San Andres (oil) 4780-5142 ft., averaging 59 ft broken lime pay, San Andres (gas) 4777-4910 ft.; 1 well, involving 133 ft broken pay. **Producing Area:** Developed, 75,305 acres. **Production** June 30, 1947: Daily, 57,695 bbls. Cumulative: 101,939.752 bbls. Estimated remaining reserves: 312,237,000 bbls. **Producing Wells June 30, 1947:** Total, 2109 (flowing, 1546; artificial lift, 563; gas, 1). **Gravity:** 30-32. **Rigs Running June 30, 1947:** 16. **Deepest Test:** T. P. Coal & Oil's Rucker 1, SEC Labor 15, League 43, Rains CSL Hockley County, failure in Clear Fork at 6005-7850 ft.; plugged back for gas discovery in San Andres. **Oil Outlets:** Magnolia, Richardson P. L. Co., South Plains P. L. Co., Stanolind, Texas-New Mexico. **Principal Leaseholders:** Stanolind, Honolulu Oil, Atlantic, Cities Prod. Corp., Continental, Devonian Oil, Gulf, Humble, Geo. P. Livermore, Alex McCurchin, Magnolia, Sid W. Richardson, Skelly, Sunray, Superior, Texas, Texas Pacific Coal and Oil, Tide Water. **Remarks:** Embraces largest producing field in district. Not explored below the Clear Fork (Permian). Hundreds of wells remain to be drilled in northwest sector, centering upon Hockley-Cochran County line. The latter sector is advancing by stages eastward to eventually link with west portion of Levelland field.

COCHRAN

DEAN

Discovery Data: Geology. **Discovery Well:** Pete Wiggins-Ed Hyde et al's Dean-Slaughter 1, center tr 26, 1346 ft. from n and 11,660 ft. from w lines League 92, Lipscomb CSL, March 6, 1938. **Type of Structure:** Stratigraphic trap combined with slight folding. **Producing Formations:** San Andres limestone 4907-5076 ft., averaging 96 ft. penetration. **Productive Area:** Developed, 1080 acres. **Production June 30, 1947:** Daily, 530 bbls. Cumulative: 839,658 bbls. Estimated remaining reserves: 3,480,000 bbls. **Producing Wells June 30, 1947:** Total: 27 (flowing 5: artificial lift, 22). **Gravity:** 30-31. **Rigs Running June 30, 1947:** None. **Deepest Test:** Stanolind & Unit Members' Dean 10-A, NEC Labor 10, League 93, Mills CSL, failure in San Andres at 5262 ft. **Oil Outlets:** Magnolia, South Plains and Stanolind. **Principal Leaseholders:** Magnolia, Stanolind, Geo. P. Livermore, Skelly, Texas Gulf Producing. **Remarks:** Considerable development will occur when crude price justifies as average crude yield per acre will be subnormal for San Andres. Area to be consolidated with Slaughter.

LANDON

Discovery Data: Geology. **Discovery Well:** Stanolind's J. F. Edwards 1, 660 ft. EWL and 1980 ft. SNL PSL 13, Blk. L, completed July 11, 1945. **Type of Structure:** Anticline. **Producing Formations:** San Andres 5040-5080 ft., averaging 36 ft. lime pay. **Producing Area:** 80 acres. **Production June 30, 1947:** Daily: 165 bbls. Cumulative: 94,653 bbls. Estimated remaining reserves: 305,000 bbls. **Producing Wells June 30, 1947:** Total, 2 (pumping). **Gravity:** 31-32.2. **Rigs Running June 30, 1947:** 1. **Deepest Test:** Stanolind's Hall 1, 1980 ft. NSL and 538 ft. EWL PSL 13, Blk. L, drilling below 8800 feet on Ellenburger objective. **Oil Outlet:** Stanolind P. L. Co. **Principal Leaseholders:** Stanolind. **Remarks:** Nearby failures outnumber producers.

COKE

BLACKWELL

Discovery Data: Geology. **Discovery Well:** Warren Petroleum's (was Wm. F. Morgan et al's) Craft 1, C NE NE H&TC Ry 276, Blk 1-A, completed 5-16-42. **Type of Structure:** Anticline. **Producing Formations:** Palo Pinto li at 3821-28 ft., averaging 7 ft. **Producing Area:** 40 acres. **Production June 30, 1947:** Daily: (inactive). Cumulative: 8693 bbls. Estimated remaining reserves: (inactive). **Producing Wells June 30, 1947:** Total: 1 (pumper). **Gravity:** 41.5. **Rigs Running June 30, 1947:** None. **Deepest Test:** Warren's Hamilton 1, failure in Ellenburger at 6367-675 ft. **Oil Outlet:** Trucks. **Principal Leaseholder:** Warren. **Remarks:** Failures discourage further development; discovery pumped 53 bbls daily on recent retest and heretofore not operated continually.

JAMESON

Discovery Data: Geophysics-geology. **Discovery Well:** Sun's A. Jameson 1, C SE SW H&TC 253, Blk. 1-A, completed 12-13-46. **Type of Structure:** Anticline. **Producing Formations:** Crinoidal lime 6165-480 ft., averaging 126 ft. pay. **Producing Area:** Developed, 200 acres. **Production June 30, 1947:** Daily: 664 bbls. Cumulative, 41,234 bbls. Estimated remaining reserves: 2,359,000 bbls. **Producing Wells June 30, 1947:** Total: 5 (flowing). **Gravity:** 46-49. **Rigs Running June 30, 1947:** 3. **Deepest Test:** Sun's A. Jameson 2, ½ mile north of discovery; only failure; Ellenburger 7083-114 ft. **Oil Outlets:** Trucks; 6-inch line to railhead underway. **Principal Leaseholder:** Sun. **Remarks:** Crinoidal producing area may be expanded to 800 acres or more; Ellenburger production quite probable on or near apex of structure in view of showings encountered by single downdip failure.

CONCHO

DODSON

Discovery Data: Geology. **Discovery Well:** Floyd C. Dodson, et al's Robt. Wilson 1, 425 ft. SNL and 1250 ft. EWL Sect. 1, Thomas Greene Sur., completed Dec. 20, 1941. **Type of Structure:** Anticline. **Producing Formations:** Basal Pennsylvania 3754-65 ft. **Producing Area:** 40 acres. **Production June 30, 1947:** Daily: dormant. Cumulative, 3550 bbls. Estimated remaining reserves: None. **Producing Wells June 30, 1947:** Total, 1 (dormant). **Gravity:** 45.8. **Rigs Running June 30, 1947:** None. **Deepest Test:** Discovery plugged back from Cambrian at 3925-4102 ft. **Oil Outlets:** Trucks. **Principal Leaseholder:** Discoverer controls area. **Remarks:** Discovery was small pumper.

EDEN

Discovery Data: Geology. **Discovery Well:** Eltex, Ltd.'s Martin 1, NEC Sect. 6, Wm. Hughes Sur., A-1732, completed Oct. 2, 1945. **Type of Structure:** Anticline. **Producing Formations:** Marble Falls 3787-826 ft., averaging 23 ft. sandy-lime pay. **Producing Area:** 80 acres. **Production June 30, 1947:** Daily: 20 bbls. Cumulative: 18,656 bbls. Estimated remaining reserves: 20.000 bbls. **Producing Wells June 30, 1947:** Total, 2 (pumpers). **Gravity:** 43-44. **Rigs Running June 30, 1947:** None. **Deepest Test:** Discovery plugged back from Hickory (Cambrian) sand at 4382-92 ft. **Oil Outlets:** Tank trucks. **Principal Leaseholder:** Eltex, Ltd. controls immediate area. **Remarks:** Failures virtually define field.

EDEN
(GAS)

Discovery Data: Geology. **Discovery Well:** Northern Ordnance, Inc.'s Sorrell 1, 2310 ft. SNL and 2316 ft. EWL Sect. 206, Eliza Kempner Sur., A-1743, completed May 11, 1945. **Type of Structure:** Anticline. **Producing Formations:** Bend 3294-403 ft., averaging 13 ft. lime pay. **Producing Area:** Developed, 120 acres. **Production June 30, 1947:** Gas. **Producing Wells June 30, 1947:** Total, 3 (gas). **Rigs Running June 30, 1947:** None. **Deepest Test:** City of Eden's Water Works Fee 1, 1320 ft. out out SEC Sect. 206, Eliza Kempner Sur., A-1743, fresh water well in Hickory sand at 3865-4410 feet. **Gas Outlets:** Lone Star Gas. **Principal Leaseholder:** Northern Ordnance. **Remarks:** Gas passed up by city's water well resulted in discovery. Additional gas development pending.

CRANE-ECTOR

EDWARDS

Discovery Data: Random drilling. **Discovery Well:** S. Caprito et al (was Wahlenmaier Pet. Corp's), W. P. Edwards 1, SW SW NE PSL 12, Blk. B-23, completed September 9, 1934. **Type of Structure:** Anticline. **Producing Formations:** San Andres 3185-605 ft., averaging 149 ft. of broken lime. **Producing Area:** Developed, 680 acres; Proved, 1700 acres. **Production June 30, 1947:** Daily: 507 bbls.; Cumulative 272,568 bbls. Estimated remaining reserves, 3,127,000 bbls. **Producing Wells June 30, 1947:** Total, 34; (flowing, 13; artificial lift, 21). **Gravity:** 32-36. **Rigs Running June 30, 1947:** None. **Deepest Test:** C. W. Chancellor-Slick Oil's Edwards 1,330 ft. fr SWC Sect. 30, Blk. 44, T&P Ry., T-3-S, failure in San Andres at 3716 ft. **Oil Outlets:** Gulf. **Principal Leaseholders:** S. Caprito, Steve C. Currie, Currie-Duncan-Reigle, Gulf, Magnolia, Seminole O&G Co., Fred Turner, Jr. **Remarks:** Total wells may be doubed, as proved and semi-proved acreage is ample.

JORDAN

Discovery Data: Trend Location. **Discovery Well:** H. M. Clark, Cooper and Smith's A. P. Jordan 1, near CNE NE 12, Blk. B-22, PLS Sur., Feb. 21, 1937. **Type of Structure:** Anticline. **Producing Formations:** Permain lime from 3340-700 ft., average 149 ft. penetration. **Productive Area:** Developed, 4620 acres. **Production June 30, 1947:** Daily, 5640 bbls.; Cumulative, 15,341,587 bbls. Estimated remaining reserves, 30,858,000 bbls **Producing Wells June 30, 1947:** Total, 227; (flowing: 128; artificial lift: 99). **Gravity:** 33-35 **Rigs Running June 30, 1947:** None. **Deepest Test:** Gulf-Kewanee Oil Co.'s University 1-A, 1989 ft. snl & 2067 wel Sect. 8 Blk 35. Failure in Ellenburger 9390-456 ft., plugging back to test Silurian. **Oil Outlets:** Gulf, Shell, Humble. **Principal Leaseholders:** Standard of Texas, Cities Service, Atlantic, Gulf, Kewanee Oil Co., Shell, Sinclair-Prairie, Skelly, Texas Co.; Texas Gulf Prod. Co. **Remarks:** Development of regular Permian pay has been terminated. pre-Permain production carried under separate heading.

ADD THIS MODERN MACHINE SHOP TO YOUR PLANT FACILITIES

With No Investment—Without Responsibility

Pictured above is the tool room and machine shop of the Tool and Mold Division of Murray Rubber Company. Completely equipped with the latest model machine tools and manned by experienced oil field equipment engineers, and machinists. The Tool and Mold Division is dedicated in its entirety to the production of customer's molds, metal inserts, dies, jigs, fixtures and other precision machine work.

Murray will engineer and produce your molds and perform all the machine shop operations required in the manufacture of your rubber parts. Make this machine shop a part of your plant, but without the investment, responsibility and worry it entails.

Murray Rubber

TOOL & MOLD DIVISION

CRANE

BARNSLEY

Discovery Data: Geophysics. **Discovery Well:** J. I. Moore's Barnsley 2, C NE NE PSL 42, Blk 32, completed February 29, 1944. **Type of Structure:** Anticline. **Producing Formations:** Clear Fork at 4500-4651 ft. **Producing Area:** 40 acres. **Production June 30, 1947:** Daily: Dormant. Cumulative: 12,200 bbls. Estimated remaining reserves: None. **Producing Wells June 30, 1947:** 1 pumper (inactive). **Gravity:** 34.5. **Rigs Running June 30, 1947:** 1. **Deepest Test:** Gulf's (was John I. Moore) Barnsley 3, C NE SE PSL 41, Blk 32, drilling Simpson at 8283 ft. **Oil Outlets:** Trucks. **Principal Leaseholders:** John I. Moore et al, Gulf. **Remarks:** This single-well pool situated 2⅝ miles east of south end of Sand Hills field, and prorated under latter. Well has been inactive for some months.

BLOCK 31

Discovery Data: Geophysical. **Discovery Well:** Atlantic's University 1-A-31, C NE SE Sect. 33, Blk. 31, completed November 19, 1945, as dual producer. **Type of Structure:** Anticline. **Producing Formations:** Devonian 8218-9053 ft.; 24 wells, including 11 dual, averaging 240 ft. exposed broken pay, Ellenburger 10,305-560 ft.; 11 wells, all dual, averaging 91 ft. exposed pay. **Producing Area:** Devonian (40-ac. units): 960 acres; Ellenburger (40-ac. units): 440 acres. **Production June 30, 1947:** Daily: Devonian, 2778 bbls.; Ellenburger, 1242 bbls. Cumulative: Devonian, 1,063,530 bbls.; Ellenburger, 582,490 bbls. Estimated remaining reserves: Devonian, 8,536,000 bbls.; Ellenburger, 2,498,000 bbls. **Producing Wells June 30, 1947:** Total, Devonian 24 (flowing); Ellenburger 11 (flowing). **Gravity:** Devonian, 40-47.4; Ellenburger, 43.5-47.2. **Rigs Running June 30, 1947: 1, Deepest Test:** Atlantic's (was Gulf's) University 1-Q, NW SE SE Sect. 22, Blk. 31, failure in Ellenburger 10,622-658 ft., drilled prior to field discovery. **Oil Outlets:** Atlantic, Texas-New Mexico. **Principal Leaseholders:** Atlantic, Champlin, Phillips, Sinclair, Prairie. **Remarks:** Devonian production derived from scattered pay at intervals in thick section of cherty-lime. Majority of wells completed through perforations which will be enlarged to include more pay-levels when %ow declines. Development to date has been restricted to single well on 160-acre unit; all Ellenburger wells dually completed. The producing area will be nominally enlarged.

CROSSETT AND CROSSETT 3200

Discovery Data: Geology. **Discovery Well:** Texas Co.'s Chas. W. Hobbs-Shell A-1, C N¼ N¼ H&TC Ry. 46, 35, completed August 3, 1944, first Devonian producer in Texas; Texas' Hobbs 3-B, C N¼ S¼ of H&TC 33, Blk. 35, completed January 16, 1945, as discovery Holt zone. **Type of Structure:** Anticline. **Producing Formations:** Devonian, 5220-406 ft.; 12 wells, averaging 70 ft. pay; Holt, 3190-210 ft.; 1 well, 20-foot perforated zone. **Producing Area:** Devonian, 480 acres; Holt, 40 acres. **Production June 30, 1947:** Daily: Devonian, 370 bbls.; Holt, 14 bbls. Cumulative: Devonian, 360,198 bbls.; Holt, 15,379 bbls.; Estimated remaining reserves: Devonian, 1,800,000 bbls.; Holt (not important). **Producing Wells June 30, 1947:** Total: Devonian, 12; flowing, Devonian, 7; artificial lift, Devonian 5; Holt 1 (pumper). **Gravity:** Devonian, 44-46; Holt, 42. **Rigs Running June 30, 1947:** 1 (Devonian). **Deepest Test:** Texas Co.'s Hobbs 3-B, C N¼ of S¼ H&TC Ry. 33, Blk. 35, failure in Ellenburger at 6565-6710 ft.; plugged back to Holt. **Oil Outlets:** Texas-New Mexico. **Principal Leaseholders:** Atlantic, Shell, Texas Co. **Remarks:** State's first Devonian producer. Devonian zone will be expanded to south.

DUNE

Discovery Data: Geology and trend. **Discovery Well:** Magnolia's University 1, nwc Sect. 16, Blk. 30, May 15, 1938. **Type of Structure:** Anticline. **Producing Formation:** Grayburg 3095-420 ft., averaging 126 feet of broken pay. **Producing Area:** 1360 acres (developed and widely scattered). **Production June 30, 1947:** Daily, 610 bbls.; Cumulative, 1,450,475 bbls.; Estimated remaining reserves, 8,070,000 bbls. **Producing Wells June 30, 1947:** Total, 33 pumping. **Gravity:** 32-36. **Rigs Running June 30, 1947:** None. **Deepest Test:** Standard of Texas' University 1-4, C NW NW Sect. 4, Blk. 30, failure in San Andres at 3795 ft. **Oil Outlets:** Gulf, Humble. **Principal Leaseholders:** Atlantic, Byrd-Frost, General American, Great Western Prod. Co., Gulf, Kenwood Oil Co., Magnolia, Texas Co. **Remarks:** Production extends northwest-southeast 4¾ miles, linking with McElroy field on southeast, and will extend northwest to Ella Waddell field. Considerable development possible on inside leases, possibly doubling number of producers.

ELLA WADDELL

Discovery Data: Geology. **Discovery Well:** Gulf's W. N. Waddell 31, NW SE SW PSL 5, Blk. B-24, completed July 29, 1940. **Type of Structure:** Anticline. **Producing Formations:** Grayburg 3223-435 ft., averaging 161 ft. of lime pay. **Producing Area:** Developed, 200 acres; proved and semi-proved, 600 acres; **Production June 30, 1947:** Daily, 126 bbls.; Cumulative, 197,479 bbls.; Estimated remaining reserves, 703,000 bbls. **Producing Wells June 30, 1947:** Total, 5 pumpers. **Gravity:** 32-34.6. **Rigs Running June 30, 1947:** None. **Deepest Test:** Discovery plugged back from sulphur water at 4053 ft. **Oil Outlets:** Gulf **Principal Leaseholders:** Gulf controls. **Remarks:** Field will eventually be linked with Dune field to south.

GULF-HENDERSON

Discovery Data: Geology-geophysics. **Discovery Well:** Gulf's U. Henderson 1-E, 660 ft, snl 1980 ft. wel PSL 25, Blk. B-27, completed June 29, 1945. **Type of Structure:** Anticline. **Producing Formations:** Clear Fork (Tubb) 4350-445 ft., averaging 62 ft. of broken pay. **Producing Area:** Developed, 80 acres. **Production June 30, 1947:** Daily, 29 bbls.; Cumulative, 20,950 bbls.; Estimated remaining reserves, 300,000 bbls. **Producing Wells June 30, 1947:** Total: 1, flowing. **Gravity:** 35. **Rigs Running June 30, 1947:** None. **Deepest Test:** Discovery plugged back from barren Ellenburger at 6584-625 ft. **Oil Outlets:** Gulf. **Principal Leaseholders:** Gulf controls. **Remarks:** Classed as Sand Hills field for proration purposes but 3 miles northwest of nearest production (Ellenburger) and isolated by failures. Nearby failures define production, except to northwest. Discovery made small amount of oil, then classed as gasser.

HUMBLE-TUCKER (GAS)

Discovery Data: Geology. **Discovery Well:** Humble's Mrs. N. M. Tucker 1, 660 ft. from sel 4620 ft from nel H&TC Ry 23, Blk 1, completed January 15, 1946. **Type of Structure:** Anticline. **Producing Formations:** Simpson (Waddell) 5700-720 ft, involving 20 ft of perforations. **Producing Area:** 40 acres. **Producing Wells June 30, 1947:** Total: 1 (gas). **Gravity:** Gas. **Rigs Running June 30, 1947:** None. **Deepest Test:** Discovery plugged back from Ellenburger at 6040-344 ft. **Gas Outlets:** None. **Principal Leaseholders:** Humble. **Remarks:** Later development may unite this gas strike with nearby oil areas.

JONES

Discovery Data: Geology and trend. **Discovery Well:** Continental's Jones 1, C N¼ of N¼ Sect. 12, Blk. 3, completed November 8, 1941. **Type of Structure:** Anticline. **Producing Formations:** Simpson (Waddell) 5700-63 ft. **Producing Area:** 40 acres. **Production June 30, 1947:** Cumulative, 9,187 bbls. Estimated remaining reserves: Depleted. **Gravity:** 42. **Rigs Running June 30, 1947:** None. **Deepest Test:** Discovery plugged back from Ellenburger at 6045-146 ft. **Remarks:** Discovery plugged September 20, 1943.

McKEE

Discovery Data: Geology. **Discovery Well:** Magnolia's Glenn 1, 660 ft. out of NEc H&TC Ry. 20, Blk. 1, completed September 5, 1942. **Type of Structure:** Anticline. **Producing Formations:** Simpson (McKee) 6080-186 ft. averaging 26 ft of sand pay. **Producing Area:** Developed, 120 acres. **Production June 30, 1947:** Daily, 28 bbls. Cumulative: 121,098 bbls.; Estimated remaining reserves, (Not important). **Producing Wells June 30, 1947:** Total, 3 pumping. **Gravity:** 42-43. **Rigs Running June 30, 1947:** None. **Deepest Test:** Magnolia's Tucker 1, ¼-mile northeast of discovery failure in Ellenburger at 6950-7204 ft. **Oil Outlets:** Magnolia P. L. **Principal Leaseholders:** Magnolia. **Remarks:** Two failures that offset production, and small yield per well discourage further development.

SAND HILLS ELLENBURGER, WEST

Discovery Data: Geology. **Discovery Well:** Gulf's Waddell et al 1, C NW NW PSL 4, Blk. B-27, completed February 5, 1936, as discovery of Simpson oil zone (semi-sour oil). Gulf's Waddell et al 4, C SW NE PSL 4, Blk. B-27, completed April 27, 1937, as discovery of Ellenburger oil (sweet) zone. **Type of Structure:** Anticline. **Producing Formations.** Ellenburger 5910-6014 ft., averaging 33 ft. of dolomite pay. **Producing Area:** 320 acres. **Production June 30, 1947:** Daily, 436 bbls.; Cumulative, 816,410 bbls.; Estimated remaining reserves, 2,294,000 bbls. **Producing Wells June 30, 1947:** Total, 8; (flowing, 5; artificial lift, 3). **Gravity:** 41-45.9. **Rigs Running June 30, 1947:** None. **Deepest Test:** Gulf's Waddell et al 1, plugged back from barren Ellenburger at 6316-6540 ft. **Oil Outlets:** Gulf. **Principal Leaseholders:** Gulf controls area. **Remarks:** First well in area classified as Sand Hills Ordovician field, yielding semi-sour crude from Simpson; remaining 8 Ellenburger wells produce sweet crude, thus accounting for separate classification. Ellenburger wells offset to north, east and west by 6 failures; further development improbable.

SAND HILLS McKNIGHT (WAS McKNIGHT)

Discovery Data: Geology. **Discovery Well:** Gulf's McKnight 1, C SW SW PSL 9, Blk. B-21, completed June 31, 1935, as discovery for original McKnight pool. Gulf's Waddell et al 45, SWc PSL 27, Block B-26, completed February 24, 1944, as discovery for east sector. Bertrand & Bradford's Tubb-Humble 12-A-K, C SE SW PSL 17, Blk. B-32, completed March 15, 1947, as discovery for south sector. **Type of Structure:** Local high on anticlinal dome. **Producing Formations:** Upper Glorietta (McKnight) 2950-3650 ft., averaging 96 ft. of lime pay. **Producing Area:** Developed, 880 acres; Proved, 1200 acres. **Production June 30, 1947:** Daily, 1632 bbls.; Cumulative: 827,624 bbls.; Estimated remaining reserves, 5,332,000 bbls. **Producing Wells June 30, 1947:** Total, 21; (flowing, 18; artificial lift, 3). **Gravity:** 29-37. **Rigs Running June 30, 1947:** 1. **Deepest Test:** Gulf's McKnight 5, C SE PSL 1, Blk. B-21, failure in Simpson shale at 7614 ft. **Oil Outlets:** Gulf, Humble. **Principal Leaseholders:** Bertrand & Bradford, Gulf, Magnolia, Schermerhorn Oil Co., L. H. Wentz. **Remarks:** Original McKnight area disappointing in performance, except east edge. The east sector is confined to extreme northeast edge of Sand Hills structure, and majority of wells have thick pay and large initial production; latter features also apply to the south sector which may receive considerable development. The east sector has 3 dual wells.

SAND HILLS ORDOVICIAN

Discovery Data: Geology-geophysics.. **Discovery Wells:** Gulf's Waddell et al 1, C NW NW PSL 4, Blk. B-27 completed February 5, 1936, as discovery of Simpson oil zone, but other wells in immediate area produce sweet oil from Ellenburger; assigned to Sand Hills-Ellenburger, West. Gulf's Tubb 1-A, 440 ft. snl and 1320 ft. wel PSL 20, Blk. B-27, completed April 27, 1940, as Ellenburger discovery for middle south area. Gulf's Waddell et al 17, C E¼ of E¼ H&TC 15, Blk 3, completed March 26, 1941, as Ellenburger discovery for south sector Gulf's Waddell et al 43-E, 2010 ft. nsl and 1980 ft. wel PSL 20, Blk. B-26, completed April 18, 1944, as Ellenburger discovery for northeast sector, which was originally prorated as Sand Hills-Elb field. **Type of Structure:** Anticlinical Dome. **Producing Formations:** Simpson 5980-6300 ft.; 2 wells, averaging 186 ft. of broken pay, Ellenburger 5614-845 ft.; 30 wells, averaging 26 feet of dolomite pay. **Producing Area:** Simpson, 80 acres (2 wells 2 miles apart); Ellenberger, 1200 acres, embracing 3 widely separated "highs." **Production June 30, 1947:** Daily, Simpson, 35 bbls.; Ellenburger, 1009 bbls. Cumulative: Simpson, 111,600 bbls.; Ellenburger, 2,483,105 bbls. Estimated remaining reserves: Simpson, Unimportant; Ellenburger, 8,317,000 bbls. **Producing Wells June 30, 1947:** Total, Simpson, 2 (pumpers); Ellenburger, 29 (16 flowing; 13 pumping). **Gravity:** Simpson, 34.5; Ellenburger 33-42. **Rigs Running June 30, 1947:** None. **Deepest Test:** Loffland Bros. Co.'s Tubb-Gulf 3, NW NW NW PSL 9, Blk. B-27, failure in granite at 7115-58 ft.; Ellenburger topped at 5802 ft. **Oil Outlets:** Gulf, Humble, Shell. **Principal Leaseholders:** American Liberty, Atlantic, Gulf. **Remarks:** Simpson production is on northwest flank of expansive structure and will later receive more development. The 3 widely separated Ellenburger producing areas prorated along with Simpson wells as single field, while fourth Ellenburger area on extreme west edge of structure prorated separately due to oil being sweet. More development will occur in extreme south and northeast areas.

SAND HILLS TUBB

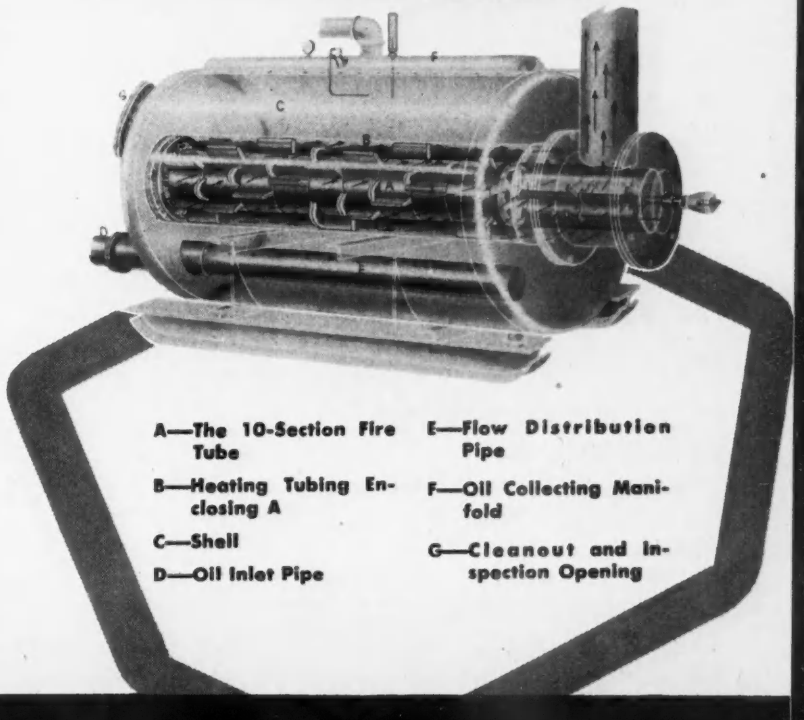
Discovery Data: Geology. **Discovery Well:** Gulf-Cranfill Bros.' J. B. Tubb 1, SE SE NE PSL 8, Blk. B-27, completed June 11, 1931, discovery for Clear Fork (Tubb) zone. **Type of Structure:** Anticlinal dome. **Producing Formations:** Clear Fork (Tubb) 4220-4952 ft., averaging 201 feet of broken lime pay. **Producing Area:** Developed 5700 acres. Proved, 9600 acres. **Production June 30, 1947:** Daily, 9250 bbls. Cumulative: 14,741,173 bbls. Estimated remaining reserves, 30,859,000 bbls. **Producing Wells June 30, 1947:** Total 267 (flowing, 175; artificial lift, 92). **Gravity:** 33-37. **Rigs Running June 30, 1947:** 6. **Deepest Test:** Discussed under Sand Hills Ordovician. **Oil Outlets:** Gulf, Humble, Shell. **Principal Leaseholders:** American Liberty, Atlantic, Bertrand & Bradford, Gulf, Humble, Robt. F. Imbt, Lario O&G Co., Magnolia, Ohio Oil Co., Schermerhorn Oil Co., Shell, Skelly. **Remarks:** This field scored the first prolific Clear Fork (Tubb) producing area. Development has been conducted conservatively due to most productive acreage being held by few companies and on large leases. Deeper and shallower zones discussed under separate headings. Clear Fork development hereafter will be largely confined to northeast sector.

REPEAT ORDERS TELL THE BEST STORY

OF HOW EFFICIENTLY PARKERSBURG HORIZONTAL HEATERS TURN EMULSIONS INTO PIPE LINE OIL!

When Parkersburg's Horizontal Type Emulsion Heater was introduced several years ago, its new approach to heat-treating of oil found many new friends. These operators found that it was almost impossible for hot spots to develop. 100% combustion gave them more, economical heat. The unique combination of convection and radiation heat not only provided greater efficiency, but minimized scale deposits and made it easier to remove the small amount of scale that did form. The new heating principle provided higher thermal efficiency. Yes, these operators found Parkersburg Horizontal Heaters the *best* way to turn emulsions into pipe line oil.

Repeat orders followed. And that's about the best recommendation for any product. Talk to your Parkersburg Representative about the valuable new features . . . the greater economy and efficiency . . . of the Parkersburg Horizontal Emulsion Heater. You can end your emulsion problems right there!



A—The 10-Section Fire Tube

B—Heating Tubing Enclosing A

C—Shell

D—Oil Inlet Pipe

E—Flow Distribution Pipe

F—Oil Collecting Manifold

G—Cleanout and Inspection Opening

THE PARKERSBURG RIG & REEL CO.

PARKERSBURG & OCS PRODUCTS

GENERAL OFFICES, PARKERSBURG, W. VA.

Plants at Parkersburg, W. Va., Coffeyville, Kan., Houston, Texas

District Offices:

Dallas - Houston - Los Angeles - Tulsa - New York

OCS

PARKERSBURG

SAND HILLS WEST

Discovery Data: Geology-geophysics. **Discovery Well:** Gulf's W. A. Estes 1, near C NW SW PSL 2, Blk. B-28, completed June 17, 1943. **Type of Structure:** Anticline. **Producing Formations:** Holt (Glorietta) 3808-3950 ft. averaging 79 ft. of broken pay. **Producing Area:** Developed, 120 acres. **Production June 30, 1947:** Daily, 17 bbls.; Cumulative, 24,865 bbls.; Estimated remaining reserves, 30,000 bbls. **Producing Wells June 30, 1947:** Total, 3 pumpers. **Gravity:** 33.5-38. **Rigs Running June 30, 1947:** None. **Deepest Test:** Discovery plugged back from water in Ellenburger at 7591-777 ft. **Oil Outlets:** Gulf. **Principal Leaseholders:** Gulf controls. **Remarks:** Field's 3 marginal pumpers located east-west within 1 mile interval. Deeper production eliminated for immediate area.

TUCKER

Discovery Data: Geology. **Discovery Well:** Magnolia's Tucker 1-B, 1868 ft from nel and 330 ft. from nwl H&TC Ry. 25, Blk. 1, completed December 18, 1945; classified as Abell field for proration. **Discovery Well:** Standard of Texas' Tucker 1, 660 ft. from sw 330 ft. from se l H&TC 21, Blk. 3, completed February 24, 1946. **Type of Structure:** Anticline. **Producing Formations:** Simpson (Waddell) sand at 5770-812 ft. averaging 18 ft. of sand pay. **Producing Area:** Developed, 80 acres. **Production June 30, 1947:** Daily, 45 bbls.; Cumulative, 9397 bbls; Estimated remaining reserves, 91,000 bbls. **Producing Wells June** 30, 1947: Total, 1 flowing. **Gravity:** 38.6-53.5. **Rigs Running June 30, 1947:** None. **Deepest Test:** Standard's Tucker 1, plugged back from Ellenburger at 6063-6303 ft. **Oil Outlets:** Trucks. **Principal Leaseholders:** Standard of Texas, Magnolia. **Remarks:** Magnolia's Tucker 1-B assigned to Abell field until depleted.

UNIVERSITY-WADDELL ELLENBURGER

Discovery Data: Geophysics. **Discovery Well:** Gulf Oil Corp's University 1-HH-E, 1980 ft. wel and 2054 ft snl Sect 3, Blk 31, completed May 29, 1947. **Type of Structure:** Anticline. **Producing Formations:** Ellenburger dolo at 10,615-875 ft.; involving 7 zones of perforations totalling 150-feet of pay. **Producing Area:** Developed, 40 acres. **Production June 30, 1947:** Daily, 220 bbls; Cumulative, 10,244 bbls; Estimated remaining reserves, 1,190,00 bbls. **Producing Wells June 30, 1947:** Total, 1 (flowing). **Gravity:** 46.3. **Rigs Running June 30, 1947:** 2. **Deepest Test:** Discovery plugged back from water at 11,060 ft. **Oil Outlets:** Gulf Refining Co. **Principal Leaseholders:** Gulf, Stanolind. **Remarks:** Classed as a major reserve of sweet Ellenburger crude, with commercial production probable from Devonian (predominately lime), Silurian, McKee and Waddell (both Simpson).

WADDELL

Discovery Data: Core drill, surface geology. **Discovery Well:** Gulf's W. N. Waddell 2, NE NE NE PSL 10, Blk. B-25, completed August 29, 1927. **Type of Structure:** Anticline. **Producing Formations:** San Andres 3210-575 ft., averaging 112 ft of broken pay. **Producing Area:** Developed, 2500 acres; Proved-Undeveloped, 1000 acres **Production June 30, 1947:** Daily, 2620 bbls.; Cumulative, 9,656,871 bbls.; Estimated remaining reserves, 20,343,-000 bbls.; **Producing Wells June 30, 1947:** Total, 141 wells (flowing, 107; artificial lift, 34). **Gravity:** 33-36. **Rigs Running June 30, 1947:** 3. **Deepest Test:** Area not explored below San Andres. **Oil Outlets:** Gulf. **Principal Leaseholders:** Gulf, Magnolia. **Remarks:** Embraces south sector of continuous producing area that includes Jordan and Penwell fields to northwest, totalling 13 miles. Gulf controls all undrilled proved acreage; engaged in continuous development. Good prospects for deeper producing zones.

CROCKETT-UPTON

CROCKETT

Discovery Data: Geology. **Discovery Well:** R. S. LeSage's (was L. H. Choate-F. T. Hogan) University-Gulf 1, 2342 ft. ewl and 1650 ft. nsl Sect. 17, Blk. 14, completed April 13, 1938. **Type of Structure:** Anticline. **Producing Formations:** Grayburg 1330-1673 ft., averaging 55 ft. of broken lime pay. **Producing Area:** Developed, 1650 acres. **Production June 30, 1947:** Daily, 382 bbls. (base allowable). Cumulative, 794,494 bbls.; Estimated remaining reserves, 7,456,000 bbls.; **Producing Wells June 30, 1947:** Total, 50. (flowing, 1; artificial lift, 49). **Gravity:** 26-30. **Rigs Running June 30, 1947:** 4. **Deepest Test:** R. S. LeSage's (was F. & J. Oil Co.) University-Gulf 10, NW SW SW Sect. 17, Blk. 14, failure at 2996 ft. **Oil Outlets:** Humble. **Principal Leaseholders:** Gilcrease Oil Co., R. S. LeSage, T. P. Coal & Oil Co., O. R. Tipps, Tr. **Remarks:** Area undergoing continuous development around edges. Rated as good prospect for deeper oil zones.

CROCKETT

BEAN

Discovery Data: Geology. **Discovery Well:** E. M. Wahlenmaier-Steve Currie's Bean A-1, C SW NE GC&SF Ry. 48, Blk. UV, completed February 19, 1941. **Type of Structure:** Anticline. **Producing Formations:** San Andres, 1451-56 ft. **Producing Area:** 40 acres. **Production June 30, 1947:** Cumulative, 4305 bbls.; Estimated remaining reserves, Depleted. **Gravity:** 26. **Rigs Running June 30, 1947:** None. **Deepest Test:** Superior Oil Co. et al's Todd 1, C SE NE GC&SF 55, Blk. UV, failure in Ellenburger at 7420-7948 ft. **Remarks:** Semicircle of failures around discovery, which was depleted and plugged November 15, 1942.

BLOCK 39

Discovery Data: Geophysics. **Discovery Well:** Stanolind's University 1-TT, C SW NW Sect. 12, Blk. 39, completed June 30, 1947. **Type of Structure:** Anticline. **Producing Formations:** Detrital (Pennsylvanian) perforations 8044-52 ft. **Producing Area:** Developed, 40 acres. **Production June 30, 1947:** Daily, 63 bbls.; Cumulative, New discovery; Estimated remaining reserves, undetermined. **Producing Wells June 30, 1947:** Total, 1 flowing. **Gravity:** 43. **Rigs Running June 30, 1947:** None. **Deepest Test:** Discovery drilled to 9000 ft. in Wilberns sandy-shale, topped at 8790 ft. **Oil Outlets:** Tank trucks. **Principal Leaseholders:** Stanolind, Shell, Amerada. **Remarks:** Discovery is ½ mi north and lower structurally than Stanolind's 1st test temporarily abandoned in Ellenburger after showing gas-distillate in detrital and some oil in Ellenburger. Area remains an important deep oil prospect.

CLARA COUCH

Discovery Data: Geology. **Discovery Well:** Cities Service's (was R. H. Henderson et al) Couch 1, 2173 ft. wel and 130 ft. nsl HE&WT 14, Blk. GG, completed August 17, 1941. **Type of Structure:** Anticline. **Producing Formations:** Grayburg and San Andres 1450-2230 ft., averaging 29 ft. of broken pay. **Producing Area:** Developed: 940 acres. **Production June 30, 1947:** Daily, 720 bbls. (base allowable); Cumulative, 405,659 bbls.; Estimated remaining reserves, 3,354,000 bbls. **Producing Wells June 30, 1947:** Total, 30. (flowing, 5; artificial lift: 25). **Gravity:** 23-33. **Rigs Running June 30, 1947:** 3. **Deepest Test:** Cities Service's Owens 1, C NW NW Sect. 14, Blk. GG, failure in San Andres at 2303 ft. **Oil Outlets:** Little Inch P. L. Co. **Principal Leaseholders:** Bay Pet. Corp., Cities Service, R. B. Honeyman, Jr., E. J. McCurdy, McElroy Ranch Co. **Remarks:** Classed as mariginal production that will continue over long period. Deep mineral rights under producing leases in big demand due to anticipated deep production.

CLARA COUCH WOLFCAMP

Discovery Data: Geology-Geophysics. **Discovery Well:** Cities Service-Humble-Plymouth Oil Co.'s J. W. Owens 1-B, C SW NW H&OB 6, Blk. GG, completed June 25, 1947. **Type of Structure:** Anticline. **Producing Formations:** Crinoidal lime at 5670-75 ft.; perforated only 5-ft. zone. **Producing Area:** Developed, 40 acres. **Production June 30, 1947:** Daily, 66 bbls.; Cumulative, 1978 bbls.; Estimated remaining reserves: 158,000 bbls. **Producing Wells June 30, 1947:** Total, 1 flowing. **Gravity:** 37.5. **Rigs Running June 30, 1947:** 3. **Deepest Test:** Discovery plugged back from Ellenburger at 6830-8264 ft. **Oil Outlets:** Texas-New Mexico. **Principal Leaseholders:** Cities Service, Humble, Plymouth, Stanolind, John I. Moore. **Remarks:** Producing zone identified as Pennsylvanian by some qualified authorities. Wolfcamp production to date has been disappointing elsewhere in district, although capable of brief flush flow. Area involves large structure, and will produce from other deep zones.

HOOVER

Discovery Data: Random drilling. **Discovery Well:** C. W. Brown et al's (was W. L. Bradley et al) A. C. Hoover 1, SW SW NW GC&SF Ry. 1, Blk. 1, completed May 18, 1938. **Type of Structure:** Anticline. **Producing Formations:** Permian 1417-60 ft., averaging 16 ft of broken lime pay. **Producing Area:** 80 acres. **Production June 30, 1947:** Daily, 14 bbls.; Cumulative, 9423 bbls.; Estimated remaining reserves, not important. **Producing Wells June 30, 1947:** Total, 1 pumping. **Gravity:** 27. **Rigs Running June 30, 1947:** None. **Deepest Test:** Discovery plugged back from 2173 ft. **Oil Outlets:** Trucks. **Principal Leaseholders:** C. W. Brown. **Remarks:** Four nearby failures discourage further development; discovery depleted.

LANCASTER HILL

Discovery Data: Core drilling. **Discovery Well:** Gulf's University 1-R, 92 ft. snl and 2753 ft. ewl Sect. 14, Blk. 29, completed April 10, 1947. **Type of Structure:** Anticline. **Producing Formations:** Grayburg 1677-85 ft., involving 8 ft. of lime pay. **Producing Area:** 40 acres. **Production June 30, 1947:** Daily, 40 bbls.; Cumulative, 3925 bbls.; Estimated remaining reserves, 156,000 bbls. **Producing Wells June 30, 1947:** Total, 1 pumping. **Gravity:** 33.3. **Rigs Running June 30, 1947:** 1. **Deepest Test:** Gulf's University 1-0, C NE NE Sect. 12, Blk. 29, 1¼ miles sw, failure in Ellenburger at 8548-8665 ft. **Oil Outlets:** Trucks. **Principal Leaseholders:** Gulf controls with 4160-acre lease block. **Remarks:** Discovery made substantial oil flow upon entering the pay with core drill.

LOFFLAND

Discovery Data: Geology. **Discovery Well:** T. W. & J. M. Loffland's V. B. Cox 1-A, 215 ft. nsl and 948 ft. wel T. C. Ry. 40, Blk. S-T, completed March 7, 1947. **Type of Structure:** Anticline. **Producing Formations:** San Andres, 995-1095 ft., consisting of 30 ft. of broken lime pay (perforated 5 zones). **Producing Area:** 40 acres. **Production June 30, 1947:** Daily, 25 bbls; Cumulative, Not produced; Estimated remaining reserves, Undetermined. **Producing Wells June 30, 1947:** Total, 1 pumping. **Gravity:** 28. **Rigs Running June 30, 1947:** None. **Deepest Test:** Discovery plugged back from 1137 ft. **Oil Outlets:** Trucks. **Principal Leaseholders:** Discoverers. **Remarks:** Discovery well shut in due to remoteness from crude outlet.

MOORE—HALFF

Discovery Data: Geology. **Discovery Well:** Moore Exploration Co.-Stanolind-Magnolia's H. M. Halff-Lee Bivins 1660 ft out of SWc I&GN 65, Blk. 1, completed July 30, 1946. **Type of Structure:** Anticline. **Producing Formations:** Glorietta (Holt) 2692-2710 ft, being 18 feet of broken lime pay. **Producing Area:** 40 acres. **Production June 30, 1947:** Daily, Inactive. Estimated remaining reserves, Unimportant. **Producing Wells June 30, 1947:** Total, 1 pumping. **Gravity:** 31.6. **Rigs Running June 30, 1947:** None. **Deepest Test:** Discovery plugged back from barren Ellenburger at 7222-7512 ft. **Oil Outlets:** Trucks. **Principal Leaseholders:** Discoverers. **Remarks:** Discovery shut in after pumping initial 3½ barrels of oil, plus 45 percent water.

MOORE—NEAL

Discovery Data: Geology. **Discovery Well:** Moore Exploration's Mrs. M. S. Neal-Standard of Texas 1, 2198 ft. nsl 467 ft. wel Sect. 2, D. L. Carver Sur., completed March 18, 1947 **Type of Structure:** Anticline. **Producing Formations:** San Andres 2284-2392 ft., embracing 108 ft. of broken lime pay. **Producing Area:** 40 acres. **Production June 30, 1947:** Daily, Inactive; Estimated remaining reserves, Unimportant. **Producing Wells June 30, 1947:** Total, 1 pumping. **Gravity:** 36. **Rigs Running June 30, 1947:** None. **Deepest Test:** Standard of Texas' University 1, C SW NE Sect. 25, Blk. 12, failure in San Andres at 2608 ft. **Oil Outlets:** Trucks. **Principal Leaseholders:** Discovery owner, with deep rights reserved by Standard of Texas. **Remarks:** Discovery pumped initial 9 bbls., and shut in. Interest in area centers upon deeper zones.

NOELKE

Discovery Data: Geology. **Discovery Well:** Texas Co.'s (was Soma O&G Co.) Noelke 1, 2500 ft. snl and 2310 ft. ewl HE&WT Ry. 30, Blk. GG, completed April 28, 1940. **Type of Structure:** Anticline. **Producing Formations:** Yates and Seven Rivers 992-1852 ft, averaging 27 ft of broken oil pay. Yates and Seven Rivers gas pay from 1030-2160 ft. **Producing Area:** Oil developed, 1000 acres; Gas developed, 320 acres. **Production June 30, 1947:** Daily, 768 bbls. (base allowable); Cumulative, 1,260,676 bbls.; Estimating remaining reserves, 4,739,000 bbls. **Producing Wells June 30, 1947:** Total Oil, 44, (flowing, 11; artificial lift, 33); Total gas, 16. **Gravity,** 32-36. **Rigs Running June 30, 1947:** None. **Deepest Test:** Moore Exploration-Olson Oil's Halff 2-C, 467 ft. nsl and 1638 ft. wel I&GN Ry. 68, Blk. 1, mile west of discovery, failure in Ellenburger 6740-6977 ft. **Oil Outlets:** Crockett P. L. Co., Texas-N. M. **Principal Leaseholders:** George Atkins, R. A. Barger, Dave Elder, J. T Holmes, Lewis & Shannon, Moore Exploration, M. & M. Production Co., Mudge Oil Co., A. J. Rife, T. P. Coal & Oil Co., Texas Co. **Remarks:** Individual well performance exceptionally erratic, with some wells registering unusually large initial flow though adjacent to dry gassers or mariginal pumpers. Oil producing area virtually defined. No market for shut in gassers.

OLSON

Discovery Data: Geology. **Discovery Well:** Plymouth Oil Co.'s (was Moore Exploration-Olson Oil Co.) Noelke 1, C NW SE Sect. 10, Blk. GG, completed June 4, 1940. **Type of Structure:** Anticline. **Producing Formations:** Grayburg 1903-2371 ft, averaging 17 ft of broken lime pay. **Producing Area:** Developed, 1050 acres. **Production June 30, 1947:** Daily, 545 bbls. (base allowable); Cumulative, 263,-940 bbls.; Estimated remaining reserves, 3,936,000 bbls. **Producing Wells June 30, 1947:** Total, 33 pumping. **Gravity,** 19-28. **Deepest Test:** Discovery drilled to 2371 ft. **Oil Outlets:** Plymouth Oil, Texas-New Mexico. **Principal Leaseholders:** Plymouth Oil, Sun. **Remarks:** Comparatively small crude yield per

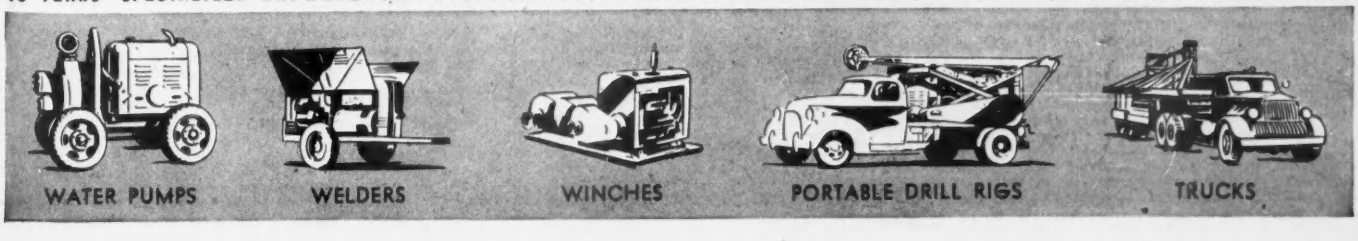
WHEN ECONOMY COUNTS, SPECIFY RED SEAL POWER

The Red Seal engine you select from the broad Continental line will fully meet the power requirements of your application. The results of this matching of power to the job are ***maximum operating efficiency, lowest maintenance cost, all-round economy.*** Add to this the rugged dependability of Red Seal engines (many have been in daily operation for 10 to 15 years or more) and you know why Continental is the one best engine for any oil field job.

Continental Motors Corporation

P. O. Box 2309, Dallas 1, Texas
205 Market St., Muskegon, Michigan
5077 S. Santa Fe, Los Angeles 11, Calif.

45 YEARS' SPECIALIZED EXPERIENCE BUILDING ENGINES FOR TRANSPORTATION, INDUSTRY, AVIATION AND THE FARM



acre. More development due; deep rights in big demand in view of opening of 5600-ft. production immediately south.

SHANNON GRAYBURG (WAS LIVE OAK)

Discovery Data: Geology. **Discovery Well:** Moore Exploration-Olson Oil's A. C. Hoover 1, NW NE SW GC&SF Ry. 16, Blk. 1, completed July 3, 1940. **Type of Structure:** Anticline. **Producing Formations:** Grayburg 1977-2150 ft., averaging 139 ft. of broken lime pay. **Producing Area:** Developed, 80 acres. **Production June 30, 1947:** Daily, 14 bbls; Cumulative, 4597 bbls.; Estimated remaining reserves, Unimportant. **Producing Wells June 30, 1947:** Total, 2 pumping. **Gravity:** 30. **Rigs Running June 30, 1947:** None. **Deepest Test:** Magnolia's Hoover 1, C SE NE GC&SF 12, Blk 1, mile sw discovery, abandoned 6160 ft. **Oil Outlets:** Texas-New Mexico. **Principal Leaseholders:** Moore Exploration. **Remarks:** Development retarded due to comparatively low crude yield per acre. Production included with Shannon-San Andres field prior to April 1, 1947, effective date of segregation.

SHANNON SAN ANDRES

Discovery Data: Geology. **Discovery Well:** Standard of Ohio-Moore Bros.' Shannon 1-12, 660 ft out of NWc Sect 12, Blk Q, John Small Sur., completed May 31, 1943. **Type of Structure:** Anticline. **Producing Formations:** San Andres 1985-2501 ft. averaging 52 ft. of broken lime pay. **Producing Area:** Developed, 1000 acres. **Production June 30, 1947:** Daily, 1149 bbls.; Cumulative, 85,614 bbls.; Estimated remaining reserves, 2,914,000 bbls. **Producing Wells June 30, 1947:** Total, 25 pumping. **Gravity:** 26.4-32. **Rigs Running June 30, 1947:** 2. **Deepest Test:** Discovery plugged back from 2567 ft. **Oil Outlets:** Texas-New Mexico. **Principal Leaseholders:** L. H. Armer, Staley Bros., Moore Exploration, John I & P. D Moore, Standard of Ohio, Sun. **Remarks:** Production includes nominal sum contributed by Shannon-Grayburg (was Live Oak) 2-well field prior to segregation, effective April 1, 1947. Considerable new development possible if crude demand and posted price warrant in view of low crude yield per acre.

SIMPSON

Discovery Data: Random drilling. **Discovery Well:** Pitzer & West's (was J. N. Simpson and originally Magnolia) A. C. Hoover 2, NE NE SE Sect. 2, Blk. FF, completed October 29, 1930. **Type of Structure:** Anticline. **Producing Formations:** Permian 1884-2105 ft., averaging 112 ft. of broken lime pay. **Producing Area:** 160 acres (scattered). **Production June 30, 1947:** Daily, 42; Cumulative, 6098 bbls.; Estimated remaining reserves, Not important. **Producing Wells June 30, 1947:** Total, 2 pumping. **Gravity,** 29-30. **Rigs Running June 30, 1947:** Total, 2 pumping. **Gravity:** 29-30. **Rigs Running June 30, 1947:** None. **Deepest Test:** Sohio's Todd 1-A-14, 663 ft nsl 1812 ft wel of E. L. Ry 14, Blk YZ, failure in Crinoidal at 6839-6985 ft. **Oil Outlets:** Trucks. **Principal Leaseholders:** C. W. Brown et al. **Remarks:** Magnolia drilled discovery on short-term lease; made small pumper, shut in for lack of market outlet; sold property on October 1, 1937, to J. N. Simpson, who revived production and later resold. Nearby failures restrict productive area.

TODD DEEP

Discovery Data: Geology. **Discovery Well:** Continental et al's Todd 2-B, C NE SW GC&SF 29, Blk. WX, completed April 3, 1940, as Crinoidal-pay discovery. Amerada et al's Todd 7-A, C SE NE GC&SF 25, Blk. WX, completed February 26, 1945, as Ellenburger-pay discovery. **Type of Structure:** Anticline. **Producing Formations:** Crinoidal (Pennsylvanian) 5565-6082 ft.; 30 wells, averaging 117 ft. of exposed lime pay. Ellenburger 5825-6425 ft; 53 wells, averaging 111 ft. of exposed pay per well. **Producing Area:** Crinoidal developed, 1200 acres; proved, 1360 acres. Ellenburger developed, 2120 acres; proved 280 (+) acres. **Production June 30, 1947:** Daily: Crinoidal 4001 bbls; Ellenburger 13,250 bbls (base allowable); Cumulative, Crinoidal 2,864,655 bbls.; Ellenburger 3,261,786 bbls.; Estimated remaining reserves: (Developed) Crinoidal 21,136,000 bbls.; Ellenburger 49,738,000 bbls. **Producing Wells June 30, 1947:** Total, Crinoidal, 30 wells (flowing 26; artificial lift 4); Ellenburger, 53 flowing. **Gravity:** Crinoidal 38.4-42.7; Ellenburger 41-42.6. **Rigs Running June 30, 1947:** 2. **Deepest Test:** F. A. Callery et al's Todd-State 1, C NW NE GC&SF 66, Blk. UV, east offset to production, failure in Ellenburger at 6610-7300 ft. **Oil Outlets:** Texas-New Mexico. **Principal Leaseholders:** Amerada et al, F. A. Callery et al, Continental et al, Atlantic, Humble. **Remarks:** Ellenburger production lies to east of Crinoidal, although 4 Crinoidal completions drilled to production in Ellenburger and plugged back. All Ellenburger wells make top allowable. Single Crinoidal pumper in West Todd included in above statistics.

TODD WEST

Discovery Data: Geophysical. **Discovery Well:** Amerada's Todd 1-C, C SW SW GC&SF 15, Blk. 10, completed September 30, 1941. **Type of Structure:** Anticline. **Producing Formations:** Crinoidal (Pennsylvanian) 6436-49 ft., involving 13 ft. of lime pay. **Producing Area:** Developed, 40 acres. **Production June 30, 1947:** Daily, 10 bbls.; Cumulative, See Todd-Crinoidal; Estimated remaining reserves, See Todd-Crinoidal. **Producing Wells June 30, 1947:** 1 flowing. **Gravity:** 37.8. **Rigs Running June 30, 1947:** None. **Deepest Test:** Discovery plugged back from barren Ellenburger at 6975-7143 ft. **Oil Outlets:** Trucks. **Principal Leaseholders:** Amerada et al. **Remarks:** Single-well area situated 3½ miles west of Todd-Crinoidal field and officially prorated under latter although nonrelated structures. Small flow and abundant water yield discourages further development.

WORLD

Discovery Data: Random drilling. **Discovery Well:** Humble-Continental's (was World Oil Co.) L. P. Powell 1, NE¼, Sect 2, Blk BB-2, June 8, 1925. **Type of Structure:** Anticlinal dome. **Producing Formations:** Grayburg 2450-2750 ft., averaging 28 ft. of broken pay. **Producing Area:** Developed, 3350 acres. **Production June 30, 1947:** Daily, 2450 bbls. (Base allowable); Cumulative: 11,091,379 bbls.; Estimated remaining reserves, 5,545,000 bbls. **Producing Wells June 30, 1947:** 109 pumping. **Gravity:** 28-30. **Rigs Running June 30, 1947:** 3. **Deepest Test:** Phillips' Schneeman 1, C NE SW, T. C. Ry 46, Blk, BB, 3½ miles southeast of field, failure in Ellenburger at 9620-9916 ft. Field proper not explored below San Andres. **Oil Outlets:** Humble. **Principal Leaseholders:** Standard of Texas, Superior, L. H. Armer, H. G. Eastham, Intercoast Pet., M&M Prod. Co., G. M. Smith. **Remarks:** Field enjoying continuous development and recording top allowable wells through improved completion methods. Deep rights throughout structure in big demand as protection against deeper oil zines remaining to be explored.

WYATT

Discovery Data: Surface Geology. **Discovery Well:** Continental's J. S. Todd 1-A, C NE SE 26, Blk W-X, GCSF Ry Sur January 17, 1933. **Type of Structure:** Anticline. **Producing Formations:** San Andres 1369-1542 ft; 3 wells, averaging 7 ft of lime pay. **Producing Area:** Developed, 120 acres (scattered units). **Production June 30, 1947:** Daily, 25 bbls; Cumulative, 46,035 bbls; Estimated remaining reserves, 18,000 bbls. **Producing Wells June 30, 1947:** 1 flowing. **Gravity:** 27-30. **Rigs Running June 30, 1947:** None. **Deepest Test:** See Todd-Ellenburger. **Oil Outlets:** Texas-New Mexico. **Principal Leaseholders:** Continental et al, Stanolind et al. **Remarks:** Three oil completions widely separated; discovery produced 17,751 bbls. prior to depletion in 1936.

DAWSON

SCANLAN

Discovery Data: Geology. **Discovery Well:** Atlantic et al's (Was E. L. Wilson-Pickens and Lomax) T. H. Scanlan 1, C NW NW ELRR 83, Blk M, September 15, 1937. **Type of Structure:** Anticline. **Producing Formations:** San Andres (Perm) 4836-932 ft (broken saturation). **Producing Area:** 40 acres. **Production June 30, 1947:** Cumulative, 1200 bbls; Estimated remaining reserves, Depleted. **Producing Wells: June 30, 1947:** 1 (depleted). **Gravity:** 35. **Rigs Runnings June 30, 1947:** None. **Deepest Test:** Childress Royalty Co.'s Scanlan 1, C SE NW ELRR 83, Blk M, failure in San Andres at 5000 ft. **Remarks:** Atlantic took over discovery and reconditioned January, 1938. Pumping yield doubled temporarily, then failed.

SPRABERRY

Discovery Data: Geology. **Discovery Well:** Seaboard's S. E. Lee 1, C NE NE T&P Ry. 47, Blk. 34, T-5-N, January 24, 1946. **Type of Structure:** Anticline. **Producing Formations:** San Andres 3720-3948 ft., averaging 163 ft. of broken lime pay. **Producing Area:** Developed, 480 acres. **Production June 30, 1947:** Daily, 435 bbls. (base allowable); Cumulative, 69,038 bbls.; Estimated remaining reserves, 2,811,000 bbls. **Producing Wells June 30, 1947:** 12 pumpers. Gravity: 32-33. **Rigs Running June 30, 1947:** 1. **Deepest Test:** Seaboard's Robinson 6-A-E, C NW SW T&P Ry. 37, Blk. 34, T-5-N, at apex of San Andres structure and an Ellenburger prospect. **Oil Outlets:** Trucks. **Principal Leaseholders:** Seaboard. **Remarks:** Field has bright outlook for profitable Clear Fork oil production uncovered by pre-discovery failure to the north. Clear Fork production will exceed that of the San Andres in area.

WELCH

Discovery Data: Random drilling. **Discovery Well:** Ray A. Albaugh et al's John Robinson 1, C NW of EL&RR Co. Sect. 46, Blk. M. November 27, 1936. **Type of Structure:** Anticline. **Producing Formations:** San Andres 4740-5038 ft, averaging 71 ft of broken lime pay. **Producing Area:** 4200 acres. **Production June 30, 1947:** Daily, 2755 bbls.; Cumulative 1,498,750 bbls.; Estimated remaining reserves, 16,500,000 bbls. **Producing Wells June 30, 1947:** 105 pumping. **Gravity:** 31-34.7. **Rigs Running June 30, 1947:** 4. **Deepest Test:** Ray A. Albaugh et al's J. Robinson-Atlantic 2, C NW NW ELRR 54, Blk. M, failure in San Andres at 5398 ft. **Oil Outlets:** Ralph Lowe P. L. **Principal Leaseholders:** Anderson-Prichard Co.; Cascade Pet. Cities Service, Coats and Foster, Ralph Lowe, Magnolia. **Remarks:** Development did not attain importance until late 1945 due to small initial of early completions and absence of market outlet. Productive area will be expanded; considered good prospect for deeper production.

ECTOR-ANDREWS

COWDEN NORTH, COWDEN DEEP NORTH

Discovery Data: Geology. **Discovery Well:** Stanolind's (was Southern Crude Oil Purchasing Co.) Cowden 1, SW SW NW T&P 26, Blk. 43-T-1-N, completed September 10, 1930, as field discovery in Grayburg. Gulf's Holt 2-H, SE SE SW PSL 1, Blk. A, completed June 24, 1939, as Holt (Glorietta) pay discovery. **Type of Structure:** Anticline. **Producing Formations:** Grayburg 4020-4880 ft., averaging 132 ft. broken pay; Holt (Glorietta) 5088-5210 ft; 39 wells, averaging 44 ft of pay. **Producing Area:** Developed, Grayburg, 25,800 acres; Holt, 1560 acres (scattered). **Production June 30, 1947:** Daily, Grayburg 22,820 bbls.; Holt, 2230 bbls.; Cumulative, Grayburg, 60,399,148 bbls; Holt, 1,128,225 bbls; Estimated remaining reserves: Grayburg, 249,200,000 bbls.; Holt, 11,352,000 bbls. **Producing Wells June 30, 1947:** Total, Grayburg, 644 (flowing 278; pumping 366); Holt, 39 (flowing 11; pumping 28). **Gravity:** Grayburg 31-35; Holt 34-39. **Rigs Running June 30, 1947:** 2. **Deepest Test:** Stanolind's W. F. Cowden 1-B, C SE SW T&P 12, Blk. 44, T-1-N, west of n end of field, failure in Pennsylvanian at 10,829 ft.; situated off structure and west of field. **Oil Outlets:** Humble. **Principal Leaseholders:** Amerada, Arrow Drlg., Cities Service, Conoco, Delaney et al, D. K. M. Co., Devonian, Intercoast, Jennings Bros., Gulf, Kiska Oil Co., Mid-Continent, Moran Bros., Ohio, Owenwood Pool, Phillips, Richmond Drlg., Rush-Griswold, Shell, Sinclair Prairie, Standard of Texas, Stanolind, Texaco, Texon, Texas Gulf, T. P. Coal & Oil, Tide Water, Winkler-Koch, Woodley Pet. **Remarks:** Regular Permian horizon includes some wells that also derive portion of production from underlying San Andres. Field output held back below average for district during most of its 17 years due to restricted market. More development possible on fringe of structure, which has not been explored below the Glorietta, thus retaining its rating as a prospective deep producing area. Holt (Glorietta) zone also held back; bulk of development within past year.

ECTOR

ANDECTOR

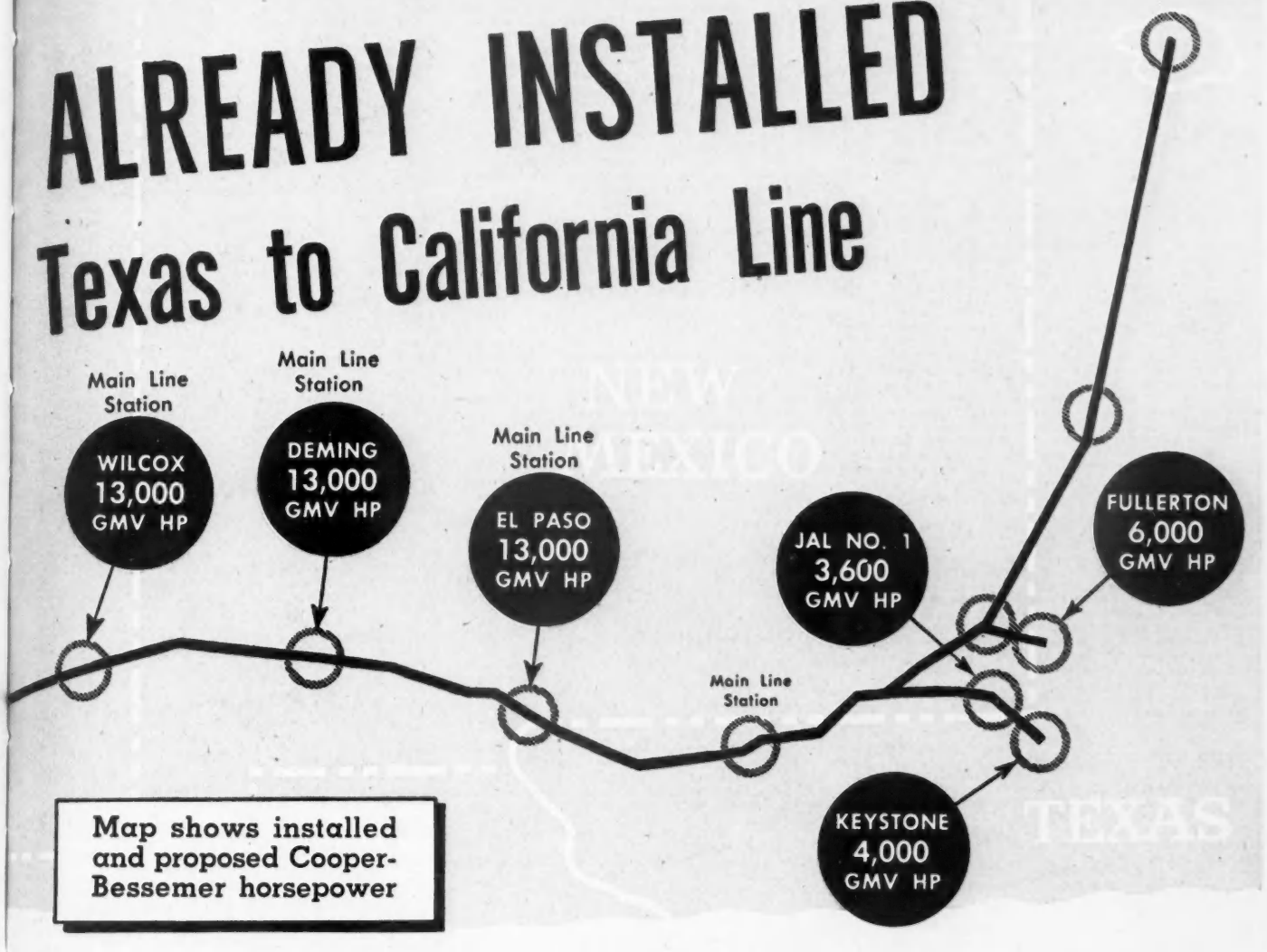
Discovery Data: Geology. **Discovery Well:** Humble's R. B. Cowden 1-B, C NE NE T&P Ry. 11, Blk. 45, T-2-N, completed October 1, 1946, as Ellenburger discovery. Plymouth's Cowden 3-A-12, 2202 ft. nsl & 2258 ft. ewl T&P Ry. 12, Blk. 45, T-2-N, completed June 24, 1947, as Clear Fork pay discovery. **Type of Structure:** Anticline. **Producing Formations:** Ellenburger 8425-8660 ft.; 12 wells, averaging 55 ft. exposed pay Clear Fork 6200-85 ft.; 1 well, involving 85 ft. of lime pay. **Producing Area:** Developed Ellenburger, 480 acres; proved Ellenburger, undrilled 800 acres; Developed Clear Fork, 40 acres; proved Clear Fork, undrilled 800 acres plus. **Production June 30, 1947.** Daily Ellenburger, 1395 bbls.; Clear Fork 120 bbls. Cumulative Ellenburger, 178,363 bbls; Clear Fork (new pay); Estimated remaining reserves: Ellenburger, 5,582,000 bbls.; Clear Fork, 400,000 bbls. (developed). **Producing Wells June 30, 1947:** 13 flowing. **Gravity:** Ellenburger 42.7-45.4; Clear Fork 39. **Rigs Running June 30, 1947:** 7. **Deepest Test:** Texas Co.-Phillips' Cowden 1, C NW NE T&P Ry. 7, Blk. 44, T-1-N, failure in Ellenburger at 8708-8967 ft.; logged oil show in Clear Fork but reached water before making drill-stem test. **Oil Outlets:** Humble. **Principal Leaseholders:** Humble, Phillips, Plymouth, Shell, Tide Water. **Remarks:** Ellenburger production defined to north by 2 failures, including 1 that showed commercial gas in San Andres; production trends south by east, undetermined miles. Clear Fork production indicated by Ellenburger tests, and on same producing contour as Goldsmith-Clear Fork area, thus raising possibility of Clear Fork production continuing across the 4½-mile interval.

ADDIS DEEP

Discovery Data: Geophysics. **Discovery Well:** Stanolind et al's Kayser 1, C SW SW T&P Ry. 34, Blk. 43, T-2-S, completed February 27, 1947. **Type of Structure:** Anticline. **Producing Formations:** Pennsylvanian ll at 8495-8565 ft., involving 2 zones of perforations aggregating 60-ft. section. **Producing Area:**

ALREADY INSTALLED

Texas to California Line



Map shows installed and proposed Cooper-Bessemer horsepower

THE El Paso Natural Gas Company has already had seven years of excellent experience with GMV angle compressors. Here's one of the reasons why reliable, efficient GMV's will supply such a big part of the compressor horsepower on this new Texas to California line.

Favorable experience is one thing. But looking to the future, GMV's also offer all that is modern and then some: compactness, low housing and installation cost, ideal adaptability to automatic control, interchangeability of precision parts, ruggedness, long life and freedom from maintenance headaches. Taken together, these and other proven advantages add up to low cost compressor service at its finest.

Today there are three Cooper-Bessemer V-angle types: the GMX from 200 to 400 hp, the GMV from 400 to 1000 hp, and the GMW from 1200 to 2400 hp. So whatever your compressor requirements may be, check with Cooper-Bessemer!

by **Cooper-Bessemer**

MOUNT VERNON, OHIO AND GROVE CITY, PENNA.

Houston, Dallas, Greggton, Pampa and Odessa, Texas Tulsa Shreveport St. Louis Los Angeles

40 acres. **Production June 30, 1947:** Daily, 25 bbls. Cumulative, 4663 bbls.; Estimated remaining reserves, No significance. **Producing Wells June 30, 1947:** 1 pumper. **Gravity:** 33. **Rigs Running June 30, 1947:** None. **Deepest Test:** Discovery plugged back from barren Ellenburger 13,500-620 ft. **Oil Outlets:** Humble. **Principal Leaseholders:** Unit participants control area with 4-section lease. **Remarks:** Discovery registered pumping potential of 155 bbls, but is actually a marginal well; doesn't warrant further development.

COWDEN SOUTH

Discovery Data: Subsurface Geology. **Discovery Well:** L. C. Harrison et al's F. V. Addis 1, C N½ N½ NW 35, Blk. 43, T&P Ry. Sur., T-2-S, January 30, 1933. **Type of Structure:** Anticline. **Producing Formations:** Grayburg 3835-4656 ft., averaging 199 ft. of broken lime pay. **Producing Area:** Developed, 5600 acres. **Production June 30, 1947:** Daily, 3068 bbls.; Cumulative, 8,192,533 bbls.; Estimated remaining reserves, 25,407,000 bbls. **Producing Wells June 30, 1947:** Total, 138 (flowing, 46; artificial lift, 92). **Gravity,** 33-36. **Rigs Running June 30, 1947:** 1. **Deepest Test:** Forest Dev. Corp's Moss 12-A, C SW SE T&P 42, Blk. 42, T-2-S, failure in Clear Fork at 6030 ft. **Oil Outlets:** Humble. **Principal Leaseholders:** Atlantic, Bond Oil Corp., Fred Turner, Jr., Union Oil, Forest Oil, Phillips, Stanolind, Shell, Skelly. **Remarks:** Producing area feathers into Foster field to north; subject to minor extensions. Development delayed due to comparatively low crude yield per acre.

DOURO

Discovery Data: Geology. **Discovery Well:** Forest Dev. Corp's Bradley 1, 467 ft. out of SEc T&P 18, Blk. 43, T-3-S, completed December 18, 1940. **Type of Structure:** Anticline. **Producing Formations:** Permian 4310-4362 ft., broken pay. **Producing Area:** 40 acres. **Production June 30, 1947:** Cumulative, 555 bbls.; Estimated remaining reserves, Depleted. **Gravity:** 29.5. **Rigs Running June 30, 1947:** None. **Deepest Test:** Forest's Bradley 2⅞ mi w of discovery, abnd 4897 ft. **Remarks:** Discovery pumped initial 102 bbls. then declined sharply, was placed on inactive list. Leases retained in area as protection against deep-production possibilities.

FOSTER

Discovery Data: Random drilling. **Discovery Well:** Stanolind's (was Barnsdall Oil Co.) Foster 1, C SE SE T&P Ry. 13, Blk. 43, T-2-S, completed December 21, 1935. **Type of Structure:** Anticline. **Producing Formations:** Grayburg 3969-4460 ft., averaging 136 ft. of broken lime pay. **Producing Area:** 10,600 acres (developed). **Production June 30, 1947:** Daily, 17,983 bbls.; Cumulative, 39,706,212 bbls.; Estimated remaining reserves, 66,293,000 bbls. **Producing Wells June 30, 1947:** Total, 628 (flowing, 114; artificial lift, 514). **Gravity:** 33-37. **Rigs Running June 30, 1947:** 5. **Deepest Test:** York & Harper-Sloan-Zook Co.'s Foster 1-D, SW NW NE T&P Ry. 8, Blk. 42, T-2-S, plugged back from barren Clear Fork at 5560-63 ft. **Oil Outlets:** Humble. **Principal Leaseholders:** Atlantic, Arkansas Fuel, Continental, Phillips, Sinclair Prairie, Stanolind York & Harper, Sunray, Texas Pacific Coal and Oil. **Remarks:** Development confined to occasional test on extreme east edge, but more drilling possible on west edge. Thirteen percent of wells have marginal well status. Largest wells on extreme east edge. Field dovetails into Johnson field on north and South Cowden on south.

GOLDSMITH

Discovery Data: Geology. **Discovery Well:** Landreth Prod. Corp's Scharbauer 1, C SE SE T&P Ry. 20, Blk. 44, T-1-N, completed November 18, 1934, as field discovery, making wet gas. Gulf's Goldsmith 1, C NW T&P Ry. 10, Blk. 44, T-1-S, completed June 14, 1935, as oil discovery and 3¾ miles southeast of the gasser. **Type of Structure:** Anticline. **Producing Formations:** San Andres 4043-4324 ft., averaging 88 ft. of broken lime pay. **Producing Area:** Developed, 20,880 acres. Proved (undrilled) 1200 acres plus. Gas. 360 acres. **Production June 30, 1947:** Daily, 22,231 bbls.; Cumulative, 75,988,609 bbls.; Estimated remaining reserves: 111,931,000 bbls. (developed). **Producing Wells June 30, 1947:** Total Oil, 987 (flowing, 892; artificial lift, 95; dormant, 55; plugged, 2). Total Gas, 9 (including wells converted from oil). **Gravity:** 35-41. **Rigs Running June 30, 1947:** 3. **Deepest Test:** Discussed under deep listings. **Oil Outlets:** Gulf, Shell. **Principal Leaseholders:** Amerada, American Marcaibo Co., Anderson-Prichard, Atlantic, Cities Service, Continental, Devonian, Gulf, Humble, Magnolia, Ohio, Manson Oil Co., Phillips, Shell, Stanolind, Texas Pacific. **Remarks:** More than 45 percent of all wells are penalized in daily allowable due to excess gor, which is forcing extensive remedial work throughout field. Original estimates on average crude yield per acre have been sharply reduced. Future development will be largely centered upon Gulf's Goldsmith 19,840-acre leasehold. Deeper zones discussed under separate headings.

GOLDSMITH CLEAR FORK

Discovery Data: Geology. **Discovery Well:** Stanolind's C. Scharbauer 3-Q, C NE SW PSL 12, Blk. A, completed March 30, 1946. **Type of Structure:** Anticline. **Producing Formations:** Clear Fork 6090-6311 ft., averaging 109 ft. of broken lime pay. **Producing Area:** 1280 acres (80-acre spacing). **Production June 30, 1947:** Daily, 1400 bbls; Cumulative, 227,569 bbls.; Estimated remaining reserves: 7,452,000 bbls. **Producing Wells June 30, 1947:** 16 flowing. **Gravity:** 40-41.3. **Rigs Runnings June 30, 1947:** 5. **Deepest Test:** Discovery plugged back from Ellenburger at 8926-9155 ft. **Oil Outlets:** Shell, Humble. **Principal Leaseholders:** Humble, Phillips, Shell, Stanolind. **Remarks:** Present 80-acre spacing pattern may be halved later. Clear Fork production due for major expansion to northwest, possibly linking with Andector field's Clear Fork zone. Favorable oil shows logged by discovery in Wichita-Albany and Silurian.

GOLDSMITH DEVONIAN

Discovery Data: Geology-Geophysics. **Discovery Well:** Gulf's Goldsmith 421-E, 1992 ft. nsl 666 ft. wel T&P Ry. 15, 44, T-1-S, completed April 28, 1947. **Type of Structure:** Anticline. **Producing Formations:** Devonian 7980-90 ft, involving 10 ft of perforations. **Producing Area:** 40 acres. **Production June 30, 1947:** Daily, Re-working; Cumulative, 2826 bbls.; Estimated remaining reserves: Undetermined. **Producing Wells June 30, 1947:** 1. **Gravity:** 38.5. **Rigs Running June 30, 1947:** 1. **Deepest Test:** Discovery plugged back from water in Ellenburger at 9685-9811 ft. **Oil Outlets:** Gulf. **Principal Leaseholders:** Gulf. **Remarks:** Discovery logged 80 ft. of broken pay above Devonian water, but failed to attain shutoff in plugging back, and will be plugged with replacement test later. Geological information points up possibility of important Devonian and Ellenburger production immediately west. Term lease will force accelerated development.

GOLDSMITH NORTH

Discovery Data: Random drilling. **Discovery Well:** Cascade Pet. Co.-Atlantic's Cummins 1, C NW NW T&P Ry. 10, Blk, 45, T-1-N, completed July 10, 1934. **Type of Structure:** Anticline. **Producing Formations:** San Andres 4226-4530 ft., averaging 221 ft. of broken pay. **Producing Area:** 480 acres (developed). **Production June 30, 1947:** Daily, 75 bbls.; Cumulative: 209,309 bbls.; Estimated remaining reserves, 1,231,000 bbls. **Producing Wells June 30, 1947:** Total, 10 (flowing, 5; artificial lift, 5; Depleted 2). **Gravity:** 32-37. **Rigs Running June 30, 1947:** None. **Deepest Test:** See Goldsmith North Deep. **Oil Outlets:** Gulf. **Principal Leaseholders:** Grisham-Hunter Corp., Hunter Corp., Magnolia, Stanolind. **Remarks:** No additional development of San Andres anticipated due to subnormal crude yield per acre.

GOLDSMITH NORTH DEEP

Discovery Data: Geophysics. **Discovery Well:** Stanolind's Graham-Hunter Corp. 1, C SW SW T&P Ry 10, Blk. 45, T-2-N, completed April 21, 1946, as Devonian-pay discovery. Phillips' Cowden-Bum 1, 667 ft. snl and 1996 ft. ewl T&P Ry. 3, Blk. 45, T-1-N, completed October 10, 1946, as discovery for Silurian pay. **Type of Structure:** Anticline. **Producing Formations:** Devonian 7919-8070 ft.; 4 wells, averaging 48 ft. of exposed chertylime pay. Silurian 8052-8280 ft.; 2 wells, averaging 69 ft. of broken lime pay. **Producing Area:** Devonian 160 acres; Silurian 80 acres. **Production June 30, 1947:** Daily, Devonian 610 bbls.; Silurian 261 bbls.; Cumulative, Devonian 171,510 bbls.; Silurian 22,665 bbls.; Estimated remaining reserves: Devonian 948,000 bbls.; Silurian 497,000 bbls. **Producing Wells June 30, 1947:** Devonian, 4 flowing; Silurian, 2 flowing. **Gravity:** Devonian, 39-43; Silurian 36.2-41.8. **Rigs Running June 30, 1947:** 1. **Deepest Test:** Stanolind's Williams 1, C NE NE T&P Ry 5, Blk 45, T-1-N, failure in Ellenburger at 10,198-290 ft., plugged back for pumper in San Andres; information gained from this initial test led to deep discoveries to east. **Oil Outlets:** Gulf, Humble. **Principal Leaseholders:** Gulf, Humble, Magnolia, Phillips, Stanolind. **Remarks:** Both producing zones subject to expansion, but development on cautious basis due to comparatively low crude yield per acre. Rise of structure to east points up possibility of Ellenburger production, which may continue east to unite with Andector field.

HARPER

Discovery Data: Geology. **Discovery Well:** Phillips' (was Broderick & Calvert) E. F. Cowden 1, 330 ft. n of center of sl T&P Ry. 25, Blk. 44, T-2-S, completed October 11, 1933. **Type of Structure:** Anticline. **Producing Formations:** San Andres 4000-4300 ft., averaging 175 ft. of broken lime pay. **Producing Area:** 4000 acres. **Production June 30, 1947:** Daily, 940 bbls. Cumulative, 10,083,833 bbls.; Estimated remaining reserves, 3,361,000 bbls. **Producing Wells June 30, 1947:** Total, 190 (flowing, 9; artificial lift, 181). **Gravity:** 35-37. **Rigs Running June 30, 1947:** None. **Deepest Test:** Cities Service's Parker-Wentz 1, C SE NE T&P Ry. 20, Blk. 44, T-2-S, failure in Ellenburger at 12,480-529 ft. **Oil Outlets:** Humble. **Principal Leaseholders:** Blackstock Oil Co., Amon G. Carter Foundation-John W. Naylor, Continental, B. J. Essex, Gulf, Honolulu & Black, Kerr-McGee Industries, Lee Drlg. Co., Mabee O&G Co., Mid-Continent, Oil Well Drlg. Co., Phillips, Shell, Stanolind, Superior, Texas Co., L. H. Wentz. **Remarks:** All wells have declined to marginal status, ranging from 16 to 2 bbls daily.

JOHNSON

Discovery Data: Geology. **Discovery Well:** Sunray's (was Landreth Prod. Corp.) J. L. Johnson 1, NWc T&P 47, Blk. 43, T-1-S, completed December 28, 1934. **Type of Structure:** Anticline. **Producing Formations:** Grayburg 4025-4331 ft., averaging 102 ft. of broken lime pay. **Producing Area:** 5200 acres (developed). **Production June 30, 1947:** Daily, 1993 bbls.; Cumulative: 6,802,180 bbls.; Estimated remaining reserves, 13,998,000 bbls. **Producing Wells June 30, 1947:** Total, 128 (flowing, 42; artificial lift, 86). **Gravity:** 33-36. **Rigs Running June 30, 1947:** None. **Deepest Test:** Sinclair Prairie's Johnson 1-A, NEc NW T&P 42, Blk. 42, T-1-S, failure in Clear Fork at 6098 ft. **Oil Outlets:** Humble. **Principal Leaseholders:** Atlantic, Cities Service, D-K-M Co., Ed J. Kubat, G. P. Livermore, North American Oil Consolidated, Sinclair Prairie, Stanolind, Sunray, Texas. **Remarks:** Substantial volume of inside locations not drilled due to wells declining to marginal status. Some leases warrant additional drilling.

JORDAN ELLENBURGER

Discovery Data: Geophysics. **Discovery Well:** Gulf-E. E. Fogelson's University 1-A, 680 ft. ewl and 662 ft nsl SW Sect 7, Blk 35, completed March 18, 1947. **Type of Structure:** Anticline. **Producing Formations:** Ellenburger 8925-35 ft, involving 10 ft of perforations. **Producing Area:** 40 acres. **Production June 30, 1947:** Daily: 180 bbls.; Cumulative, 20,111 bbls; Estimated remaining reserves, 300,000 bbls. **Producing Wells June 30, 1947:** 1 flowing. **Gravity:** 42.7. **Rigs Running June 30, 1947:** 1. **Deepest Test:** Discovery plugged back from water in Ellenburger at 8985 ft. **Oil Outlets:** Gulf. **Principal Leaseholders:** Gulf-Fogelson, Gulf-Kewanee, Shell, Texas. **Remarks:** Ellenburger production likely to involve 600 acres, with apex of structure to west. Both Devonian and Silurian zones prospective sources of oil production.

MIDWAY

Discovery Data: Geology. **Discovery Well:** Oil Well Drlg. Co.'s Johnson-Shell 1, 467 ft out of NWc T&P Ry 48, Blk 44, T-1-S, completed February 26, 1942. **Type of Structure:** Anticline. **Producing Formations:** San Andres 4210 to 4353 ft, involving 143 ft pay. **Producing Area:** 40 acres. **Production June 30, 1947:** Daily: 5 bbls. Cumulative: Included with Goldsmith. Estimated remaining reserves: Unimportant. **Producing Wells June 30, 1947:** 1 flowing. **Gravity:** 33. **Rigs Running June 30, 1947:** None. **Deepest Test:** Shell's Johnson 1, C SW SW T&P Ry 37, Blk 33, T-1-S, failure in Clear Fork 5310-7000 ft. **Oil Outlets:** Trucks. **Principal Leaseholders:** Discoverer. **Remarks:** Prorated with Goldsmith field for convenience, although 2⅝ miles southeast of latter. Production allowable penalized due to excess gas-oil ratio. Offset failure temporarily discouraged continued development.

MURCHISON

Discovery Data: Geophysics. **Discovery Well:** John W. Murchison et al's T. P. Land Trust-Texaco 1, C SE NW T&P Ry 7, Blk 45, T-2-S, completed September 10, 1946, Devonian pay discovery. American Republic's T. P. Land 1, C SW SE T&P 7, Blk 45, T-2-S, completed January 20, 1947, Wolfcamp pay discovery. **Type of Structure:** Anticline. **Producing Formations:** Devonian chert at 8510-66 ft; 1 well, involving 56 ft of broken pay. Wolfcamp li at 7795-7825 ft; 1 well, involving 30 ft of broken pay. **Producing Area:** Devonian 40 acres; Wolfcamp 40 acres. **Production June 30, 1947:** Daily: Devonian depleted; Wolfcamp 20 bbls. Cumulative: Devonian not marketed; Wolfcamp 2465 bbls. Estimated remaining reserves: Unimportant. **Producing Wells June 30, 1947:** 1 pumping (Wolfcamp). **Gravity:** Devonian 40; Wolfcamp 39.8. **Rigs Running June 30, 1947:** None. **Deepest Test:** Phillips et al's Millard 1, C NE NE PSL 2, Blk B-15, failure in Ellenburger at 10,834-11,000 ft. **Oil Outlets:** Magnolia. **Remarks:** Resumption of development contingent upon results of further geophysical survey of the structure. Devonian pay discovery proved noncommercial and plugged April 1, 1947, while Wolfcamp pay discovery pumper, which is officially assigned to TXL field, not commercial considering depth.

PENWELL

Discovery Data: Geology. **Discovery Well:** Texas Co.'s (was Josh S. Cosden) W. E. Connell 1, C NE PSL 13, Blk B-16, December 28, 1926. **Type of Structure:** Anticline. **Producing Formations:** San Andres 3392 to 3760 ft, averaging 137 of broken lime pay. **Producing Area:**

5920 acres. **Production June 30, 1947:** Daily: 2745 bbls. Cumulative: 28,180,025 bbls. Estimated remaining reserves: 22,140,000 bbls. **Producing Wells June 30, 1947:** Total 175 (flowing, 60; artificial lift, 115). **Gravity:** 33-37. **Rigs Running June 30, 1947:** None. **Deepest Test:** E. E. Fogelson-Cosden Pet.'s University 1-C-D, C SW NW Sect 1, Blk 35, failure in Ellenburger at 9316-9356 ft. **Oil Outlets:** Gulf, Humble, Shell. **Principal Leaseholders:** Amerada, W. A. Black & Sons, Callahan & O'Donnell, Cosden Pet., J. H. Elder, George E. Farley, Gulf, Humble, Lynch Oil Co., Ohio Oil, Republic Supply Co., Shell, Sinclair Prairie, Skelly, Stanolind, Sunray, Texas Co., Tide Water. **Remarks:** Discovery well was first producer for county, and on extreme west edge of structure. Nearby development yielded small wells, and development lagged until October, 1929, when Penn Oil-Humble's TXL 1, 2 miles northeast original wells, opened prolific sector. No additional development of San Andres zone anticipated. Ellenburger production on northwest flank discussed under Penwell-Ellenburger.

PENWELL ELLENBURGER

Discovery Data: Geology-geophysics. **Discovery Well:** Phillips et al's Eidson-Scharbauer Unit 1, 1997 ft snl and 1827 ft wel PSL 25, Blk B-15, completed April 20, 1946. **Type of Structure:** Anticline. **Producing Formations:** Ellenburger 8888 to 8910 ft, involving 22 ft of pay. **Producing Area::** 40 acres. **Production June 30, 1947:** Daily: 42 bbls. Cumulative: 14,172 bbls. Estimated remaining reserves: 120,000 bbls. **Producing Wells June 30, 1947:** 1 flowing. **Gravity:** 43.5. **Rigs Running June 30, 1947:** None. **Deepest Test:** Discovery plugged back from water at 9020 ft. **Oil Outlets:** Gulf. **Principal Leaseholders:** Area controlled by 5 companies that unitized deep rights. **Remarks:** Discovery passed up prospective production in the Glorietta and 7700-foot Silurian; failed to obtain water shutoff in drilling to water table in Ellenburger.

TXL CLEAR FORK, SILURIAN AND WOLFCAMP

Discovery Data: Geology. **Discovery Wells:** Shell-Arkansas Fuel's Thomas 1-E, 660 ft snl and 2004 ft ewl T&P 32, Blk 45, T-1-S, completed June 11, 1946, discovery for Wolfcamp zone. Phillips' TXL 1-E-A, C NW NW T&P 39, Blk 45, T-1-S, completed July 9, 1946, discovery for Clear Fork zone. Superior's Parker 7, 2005 ft ewl and 665 ft nsl T&P 40, Blk 45, T-1-S, completed December 20, 1946, Silurian pay discovery. **Type of Structure:** Faulted anticline. **Producing Formations:** Wolfcamp 7545 to 7695 ft; 1 well, involving 150 of exposed pay (broken). Clear Fork 5400 to 5810 ft; 8 wells averaging 129 ft of lime pay. Silurian 8465 to 8692 ft; 2 wells, averaging 63 ft of lime pay. **Producing Area:** Wolfcamp: 40 acres. Clear Fork: Developed 320 acres; proved undrilled 1500 acres plus. Silurian: Developed 80 acres. **Production June 30, 1947:** Daily: Wolfcamp depleted; Clear Fork, 756 bbls (base allowable); Silurian, 331 bbls. Cumulative: Wolfcamp 2751 bbls; Clear Fork 64,324 bbls; Silurian 19,933 bbls. Estimated remaining reserves: Wolfcamp depleted; Clear Fork 1,856,000 bbls (developed); Silurian 460,000 bbls (developed). **Producing Wells June 30, 1947:** Wolfcamp depleted. Clear Fork 8 flowing; Silurian 2 flowing. **Gravity:** Wolfcamp 35.5; Clear Fork 33.8-39.5; Silurian 39. **Rigs Running June 30, 1947:** 2 Clear Fork. **Deepest Test:** See TXL Ellenburger. **Oil Outlets:** Shell, Humble, Standish P. L. pending. **Principal Leaseholders:** Mid-Continent, Phillips, Rowan Drlg. Co., Shell-Arkansas Fuel, Superior. **Remarks:** Clear Fork and Silurian zones productive over large portion of structure, and will eventually be drilled up. Numerous Ellenburger wells passed up prolific flow, determined by drill-stem tests, in Silurian; a few encountered commercial production in Simpson, which has not been placed on production.

TXL DEVONIAN

Discovery Data: Geophysics. **Discovery Well:** Shell-Cities Service's TXL 1, C SE SE T&P Ry 7, Blk 45, T-1-S, completed January 3, 1945. **Type of Structure:** Faulted anticline. **Producing Formations:** Devonian 7698 to 8202 ft, averaging 117 ft of exposed cherty-lime pay. **Producing Area:** Developed: 3760 acres; proved undrilled 800 acres plus. **Production June 30, 1947:** Daily: 13,366 bbls. Cumulative: 5,361,358 bbls. Estimated remaining reserves: 30,359,000 bbls (developed). **Producing Wells June 30, 1947:** Total: 94 (flowing 86; artificial lift 8). **Gravity:** 37.6-43.8. **Rigs Running June 30, 1947:** 6. **Deepest Test:** See TXL Ellenburger. **Oil Outlets:** Humble, Shell, Standish P. L. pending. **Principal Leaseholders:** Amerada, Atlantic, Cities Service, Continental, Mid-Continent, Phillips, Rowan Drlg. Co., Shell, Shell-J. C. Barnes, Shell-Arkansas Fuel, Sinclair Prairie, Skelly, Superior, Texas Co. **Remarks:** Largest Devonian producing area in state. Production extends northwest-southeast 8¼ miles, with southeast trend subject to extensions; maximum width of 1½ miles. Excepting few wells, Devonian not productive under Ellenburger sector, which occupies east portion of structure.

WITH THE HELICOID GAGE YOU SAVE ON SERVICE

HERE'S WHY:

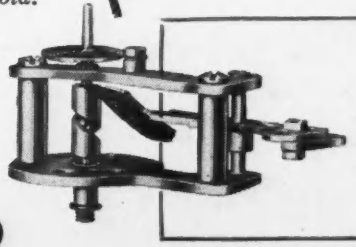
1. Any Helicoid Pressure Gage can be recalibrated without removing dial or pointer.

2. Hairline pointer adjustments can be made quickly from the back of the case without removing dial, pointer or glass.

These advantages—exclusive with Helicoid—save costly man-hours. One large user claims they save several hours a day.

Reduction in maintenance cost is important. Helicoid gages stay accurate longer and are the easiest to keep in calibration. That's why they have proved to be the least expensive gages to buy.

Send for the New Catalog that tells the complete story of Helicoid.



Only Helicoid pressure gages have the Helicoid movement.

ACCO

HELICOID GAGE DIVISION
AMERICAN CHAIN & CABLE
Bridgeport 2, Connecticut

TRADE MARK

TXL ELLENBURGER

Discovery Data: Geology. **Discovery Well:** Shell's Thomas 1-A, C NW NW T&P Ry 8, Blk 45, T-1-S, ⅝ mile northwest of Devonian discovery, completed May 15, 1945. **Type of Structure:** Faulted anticline. **Producing Formations:** Ellenburger 930 to 9855 ft, averaging 130 ft of exposed dolomite pay. **Producing Area:** Developed: 4520 acres. Proved undrilled: 800 acres plus. **Production June 30, 1947:** Daily: 30,714 bbls. Cumulative: 6,618,473 bbls. Estimated remaining reserves: 106,382,000 bbls (developed). **Producing Wells June 30, 1947:** 112 flowing; 1 depleted and PB to Devonian. **Gravity:** 41.7-45.9. **Rigs Running June 30, 1947:** 15. **Deepest Test:** Shell's Thomas 3, C NE NE T&P 28, Blk 45, T-1-S, cut fault on southeast edge of field, barren Ellenburger 10,906-11,051 ft, plugged back to complete in Clear Fork. **Oil Outlets:** Shell, Humble, Standish P. L. pending. **Principal Leaseholders:** Amerada, Atlantic, J. C. Barnes, Cities Service, Continental, Mid-Continent, Ohio, Phillips, Rowan Drlg. Co., Shell, Shell-Arkansas Fuel, Skelly, Superior, Texas Co. **Remarks:** Adjoins TXL Devonian sector of structure on east; extends northwest-southeast 8¼ miles, with maximum width of 2 miles. Producing area will be expanded in north two-thirds portion of east side and on extreme ends. Adjoining 2-well Ellenburger field across fault discussed separately.

TXL ELLENBURGER, SOUTHEAST

Discovery Data: Geology. **Discovery Well:** Texas Co.'s TXL-Fraser 1-D, C SW NW T&P Ry 27, Blk 45, T-1-S, ¾ mile east and across fault from nearest TXL Ellenburger well, completed February 7, 1946. **Type of Structure:** Faulted anticline. **Producing Formations:** Ellenburger 10,750-890 ft, averaging 107 ft of exposed pay. **Producing Area:** Developed: 80 acres. **Production June 30, 1947:** Daily: 806 bbls. Cumulative: 124,004 bbls. Estimated remaining reserves: 1,876,000 bbls. **Producing Wells June 30, 1947:** 2 flowing. **Gravity:** 41.9-42.2. **Rigs Running June 30, 1947:** 1. **Deepest Test:** Phillips' TXL 1-E-A, C NW NW T&P Ry 39, Blk 45, T-1-S, failure in Ellenburger 11,285-11,506 ft, plugged back for Clear Fork production. **Oil Outlets:** Shell, Standish P. L. pending. **Principal Leaseholders:** Texas Co. **Remarks:** Involves accumulation on downthrow side of steep fault that terminates Ellenburger production on the southeast side of main TXL structure. Ellenburger failures offset discovery to north and northwest. Extent of producing area is speculative.

GAINES-YOAKUM

WASSON DEEP

Discovery Data: Routine deep explorations. **Discovery Well:** Amon G. Carter Foundation's (was Amon G. Carter) Wasson 5-D, 2200 ft wel and 440 ft nsl PSL 50, Blk AX, completed December 24, 1940, discovery of Wasson "66" zone. Amon G. Carter Foundation's (was Amon G. Carter) Wasson 4-D, 2200 ft out of SEc PSL 50, Blk AX, completed December 20, 1941, discovery of Wasson "72" zone. **Type of Structure:** Anticline. **Producing Formations:** Wasson "66": Upper Clear Fork 6210 to 6975 ft; 19 wells, averaging 317 ft broken pay. Wasson "72": Clear Fork (Tubb) 7015 to 7730 ft; 12 wells, averaging 333 ft broken pay. **Producing Area:** Developed: Wasson "66" zone 1520 acres; Wasson "72" zone 960 acres. **Production June 30, 1947:** Daily: Wasson "66" 1660 bbls; Wasson "72" 433 bbls. Cumulative: Wasson "66" 1,036,390 bbls; Wasson "72" 549,940 bbls. Estimated remaining reserves: Wasson "66" 4,436,000 bbls; Wasson "72" 2,907,000 bbls. **Producing Wells June 30, 1947:** Total: Wasson "66" 18 (flowing, 17; inactive, 1); Total Wasson "72" 12 (flowing 10; artificial lift, 2). **Gravity:** Wasson "66" 32-35; Wasson "72" 32-35. **Rigs Runnings June 30, 1947:** 1. **Deepest Test:** Amon G. Carter's Wasson 4-D, failure in Ellenburger at 10,545-11,108 ft; plugged back to make discovery of Wasson "72" zone. **Oil Outlets:** Shell, Stanolind, Atlantic. **Principal Leaseholders:** Amon G. Carter Foundation et al, Continental et al, Honolulu. **Remarks:** Both zones developed on 80-acre spacing pattern. Six wells producing from both zones, as dual completions. Honolulu's Hovencamp 9, C W½ W½ NE Sect 890, Blk D, Yoakum County, is 2¼-mile northeast outpost pumper for deeper zone. Productive limits of both zones will be expanded.

GAINES

CEDAR LAKE

Discovery Data: Geophysics. **Discovery Well:** Stanolind's J. B. Rayner 1, C SW SW PSL 3, Blk C-30, September 18, 1939. B. H. Nolen et al's Jones-Stanolind 1, C SW SW D&W Ry 2, Blk H, completed June 15, 1946, gas discovery in Yates. **Type of Structure:** Anticline. **Producing Formations:** San Andres 4550-4830 ft, average 160 ft, broken pay. Yates (gas) 2926 ft. **Productive Area:** Oil 2560 acres. Gas: 40 acres. **Production June 30, 1947:** Daily: 1905 bbls. Cumulative: 3,576,643 bbls. Estimated remaining reserves: 6,663,000 bbls. **Producing Wells June 30, 1947:** 57 pumping; 1 gas well. **Gravity:** 33-34. **Rigs Runnings June 30, 1947:** 2. **Deepest Test:** Stanolind's American Warehouse 15, SE NW SE Sect 5, Blk H, D&W Sur. Failure at 11,954 ft in lime and chert, possibly Pennsylvanian. **Oil Outlets:** Atlantic, Stanolind. **Principal Leaseholders:** Stanolind, W. A. Moncrief, Mid-Continent, Nolen & Byrom, Samedan Oil Corp. **Remarks:** No gas of any consequence accompanies oil. All wells completed on artificial lift. Gas repressuring underway since spring, 1946, to try to check decline in reservoir pressure, originally calculated at 1950 pounds psl, dropping at rate of 800 pounds per million barrels of oil produced up to September, 1946. Nominal amount of drilling still possible on edge of field.

DOSS

Discovery Data: Geophysics. **Discovery Well:** Humble's M. S. Doss-Humble 1, C SW SW PSL 9, Blk A-24, completed November 28, 1944, lower pay Humble's M. S. Doss 1, C SW SW PSL 1, Blk A-24, completed April 16, 1946, upper pay discovery. **Type of Structure:** Anticline. **Producing Formations:** Basal Clear Fork 6975 to 7175 ft; 19 wells, averaging 105 ft of broken lime pay. Clear Fork (Tubb) 6040 to 6475 ft; 1 well, involving 4 zones of perforations totalling 160 ft of section. **Producing Area:** Lower pay: 760 acres; upper pay, 40 acres. **Production June 30, 1947:** Daily: 779 bbls (both zones). Cumulative: 266,445 bbls (both zones). Estimated remaining reserves: 3,734,000 bbls (both zones). **Producing Wells June 30, 1947:** Total lower pay: 18 (flowing, 13; pumping, 5). Total upper pay: 1 pumper. **Gravity:** Lower pay 30-39.4; upper pay 29.2. **Deepest Test:** Discovery plugged back from barren Wolfcamp at 9049 ft. **Oil Outlets:** Humble's relay line to Magnolia. **Principal Leaseholders:** Humble, DeKalb Ag. Assn., Warren King and Dye. **Remarks:** Northwest sector lists most productive wells; major extensions will be made to northwest.

HOMANN (GAS)

Discovery Data: Geology-geophysics. **Discovery Well:** Honolulu's E. B. Homann 1, C SE SE WT Rv 96, Blk G, completed December 6, 1943. **Type of Structure:** Anticline. **Producing Formations:** Yates sd at 3475-90 ft, totalling 15 ft broken pay. **Producing Area:** Developed: 40 acres. **Production June 30, 1947:** Gas. **Producing Wells June 30, 1947:** 1. **Gravity:** Gas. **Rigs Running June 30, 1947:** None. **Deepest Test:** Discovery plugged back after testing small amount free oil and brackish water in San Andres 5030-5457 ft. **Gas Outlets:** Stanolind to Cedar Lake field for repressuring project. **Principal Leaseholders:** Atlantic, Gulf, Honolulu, Devonian. **Remarks:** San Andres oil production within immediate area quite probable; failures 1½ miles or more from gasser.

JONES RANCH

Discovery Data: Geophysics-geology. **Discovery Well:** Amerada's E. H. Jones 1-A, C NW NE PSL 3, Blk A-6, completed November 13, 1945. **Type of Structure:** Anticline. **Producing Formations:** Devonian 11,181 to 11,395 ft, averaging 85 ft of exposed pay. **Producing Area:** Developed: 120 acres. **Production June 30, 1947:** Daily: 720 bbls. Cumulative 303,000 bbls. Estimated remaining reserves: 897,000 bbls. **Producing Wells June 30, 1947:** 3 flowing. **Gravity** 43.5. **Rigs Runnings June 30, 1947:** 1. **Deepest Test:** Amerada's Jones 2-A, C SE NE PSL 3, Blk A-6, highest Devonian well, logged Simpson-granite contact at 12,-900 ft, pb from granite at 12,924 ft for Devonian production. **Oil Outlets:** Stanolind. **Principal Leaseholders:** Amerada. **Remarks:** Three Devonian failures partially define productive area. Ellenburger production will be sought down dip from the "granite high."

KIRK

Discovery Data: Subsurface geology. **Discovery Well:** Landreth Prod. Corp.'s W. H. Kirk 1, SW SW SW PSL Sect 22, Blk A-21, September 29 1936. **Type of Structure:** Anticline. **Producing Formations:** San Andres 4796 to 4850 ft, involving 54 feet of broken lime pay. **Producing Area:** 40 acres. **Production June 30, 1947:** Dormant. **Producing Wells June 30, 1947:** Dormant. **Gravity:** 26-28. **Deepest Test:** Anderson-Prichard's Dalmont 1, C NW NE PSL 3, Blk 22, failure at 5000 ft. **Remarks:** Discovery is isolated from market outlet and not produced. Area not important except for deep possibilities.

RILEY

Discovery Data: Geology. **Discovery Well:** Cities Service's T. S. Riley 1, C NE NE Sect 361, Blk G, CCSD&RGNG Sur, completed June 10, 1947. **Type of Structure:** Anticline. **Producing Formations:** Clear Fork lime at 7045-7237 ft, consisting of 192 ft of broken pay. **Productive Area:** Developed: 40 acres. **Production June 30, 1947:** Daily: 42 bbls. Cumulative: New field. Estimated remaining reserves: Undetermined. **Producing Wells June 30, 1947:** 1 pumping. **Gravity:** 33.1. **Rigs Runnings June 30, 1947:** 1. **Deepest Test:** Discovery plugged back from Wichita-Albany at 7245-51 ft. **Oil Outlets:** Trucks. **Principal Leaseholders:** Cities Service, Magnolia, Tide Water. **Remarks:** Discovery indicated larger producing ability in early stages of completion. Short-term leases in immediate area will cause considerable drilling if later completions warrant.

ROBERTSON

Discovery Data: Geology. **Discovery Well:** Texas Co.'s Robertson 1, C NW NE PSL 25, Blk A-21, completed November 9, 1942, field discovery in Glorietta lime. Texas Co.'s Robertson 2, C NE NE PSL 21, Blk A-24, completed March 9, 1945, Upper Clear Fork pay discovery. **Type of Structure:** Anticline. **Producing Formations:** Glorietta 5870 to 5985 ft; 3 wells, averaging 70 ft broken lime pay. Upper Clear Fork 6335 to 6430 ft; 4 wells, averaging 64 ft of broken pay. **Producing Area:** Glorietta: 120 acres; Upper Clear Fork: 160 acres. **Production June 30, 1947:** Daily: Glorietta: 135 bbls; Upper Clear Fork: 180 bbls (base allowable). Cumulative: 171,455 bbls (both zones). Estimated remaining reserves: 949,000 bbls (both zones). **Producing Wells June 30, 1947:** Glorietta: 3 pumping. Total Upper Clear Fork: 4 (flowing, 3 pumping, 1). **Gravity:** Glorietta 26-33.5; Upper Clear Fork 29-32. **Rigs Running June 30, 1947:** 1. **Deepest Test:** Discovery plugged back from Lower Clear Fork 7686 ft. **Oil Outlets:** Texas Co. to Magnolia. **Principal Leaseholders:** Samedan Oil Corp. et al, Texas Co. **Remarks:** Both pays somewhat erratic in performance, thus accounting for slow development.

RUSSELL

Discovery Data: Geology-geophysics. **Discovery Well:** Shell's Leaverton 1, C SW SW Sect 458, Blk G, CCSD&RGNG Sur, completed February 12, 1943, field discovery in Basal Clear Fork. Shell's Jones 2-A, C SW NE Sect 490, Blk G, CCSD&RGNG Sur, completed April 3, 1945, Upper Clear Fork pay discovery. **Type of Structure:** Anticline. **Producing Formations:** Basal Clear Fork 7282 to 7995 ft; 23 wells, averaging 367 ft broken pay. Upper Clear Fork 6050 to 6140 ft; 2 wells, averaging 50 ft broken lime pay. **Producingg Area:** Developed: Basal Clear Fork 920 acres; Upper Clear Fork 80 acres. **Production June 30, 1947:** Daily: Basal Clear Fork, 2196 bbls (base allowable); Upper Clear Fork 228 bbls. Cumulative: Basal Clear Fork 929,604 bbls; Upper Clear Fork 74,958 bbls. Estimated remaining reserves: Basal Clear Fork 4,590,000 bbls; Upper Clear Fork, 325,000 bbls. **Producing Wells June 30, 1947:** Total Basal Clear Fork 23 (flowing 13; pumping 10); Total Upper Clear Fork 2 flowing. **Gravity:** Basal Clear Fork 32-35.7; Upper Clear Fork 32-34.4. **Rigs Running June 30, 1947:** 1. **Deepest Test:** Argo's Jones 1-A, C NE SW Sect 490, Blk G, CCSD&RGNG Sur, failure in Wolfcamp at 9305-9668 ft. **Oil Outlets:** Atlantic. **Principal Leaseholders:** C. U. Bay-Newfoundland Co., Magnolia, Shell. **Remarks:** Considerable development possible in lower pay, but kept on conservative basis due to comparatively low crude yield per acre, considering depth.

SEMINOLE

Discovery Data: Geophysical. **Discovery Well:** Amerada et al's S. J. Averitt-Ohio 1-A, C NE NE 228, Blk G, WT Ry Sur, January 8, 1937. **Type of Structure:** Anticlinal dome. **Producing Formations:** San Andres 5010 to 5282 ft, averaging 146 ft of lime pay. **Productive Area:** Developed: 13,200 acres. **Production June 30, 1947:** Daily: 19,797 bbls. Cumulative: 35,858,223 bbls. Estimated remaining reserves: 162,142,000 bbls. **Producing Wells June 30, 1947:** Total 326 (flowing, 302; artificial lift, 24). **Gravity:** 33-35. **Rigs Running June 30, 1947:** 2. **Deepest Test:** Amerada's Robertson 6, C NW SE WT Ry 196, Blk G, failure in Wolfcamp at 9312 ft; plugged back to regular pay. **Oil Outlets:** Magnolia, Atlantic. **Principal Leaseholders:** Amerada, Atlantic, Humble, Skelly, Magnolia, Central American Oil Co., Bay Pet. **Remarks:** Unusually effective San Andres pay zone with good volume of gas. Future development will be restricted to few wells around edge of structure, pending outcome of projected 10,000-foot Devonian test in field proper, where deeper pays probable.

GARZA

GARZA

Discovery Data: Random drilling. **Discovery Well:** M. L. Richards' J. R. Sullivan 1, NW NW NW Sect. 3, Blk. 5, Aycock Sur, July 26, 1935. **Type of Structure:** Anticline. **Producing Formations:** San Andres 2731-3156 ft, averaging 132 ft of broken lime pay. **Producing Area:** 3000 acres (developed). **Production June 30, 1947:** Daily: 4328 bbls. Cumulative: 2,094,685 bbls. Estimated remaining reserves: 12,905,000 bbls. **Producing Wells June 30, 1947:** Total: 146 pumping. **Gravity:** 35-36. **Rigs Running June 30, 1947:** 5. **Deepest Test:** Geo. & Herman Brown-Comanche Corp's Montgomery & Davies 11-A, NW SE SW TT Ry 1236, A-775, ne portion of field, failure at 6010 ft, pb to regular pay. **Oil Outlets:** Scurlock's relay line to tank car rack; Stanolind entering with line. **Principal Leaseholders:** Brown & Comanche Corp., General American, Grisham Hunter; Lynn Oil

Pumping six Wells with NIXON GAS LIFTS and COMPRESSOR PLANT

The six wells are producing 450 bbls. of oil and 193 bbls. salt water per day.

The first Nixon Gas Lift was installed Jan. 5, 1942. The six wells average but ONE pulling job a year.

With this equipment the lifting cost on this lease has been reduced to 16¢ per barrel of oil.

Among the several thousand Nixon Gas Lifts now in the field, more than 2000 have been in continuous use for more than 5 years.

Yes—to lower the cost of producing your oil—use the Nixon Surface Control Gas Lift.

WRITE FOR COMPLETE INFORMATION

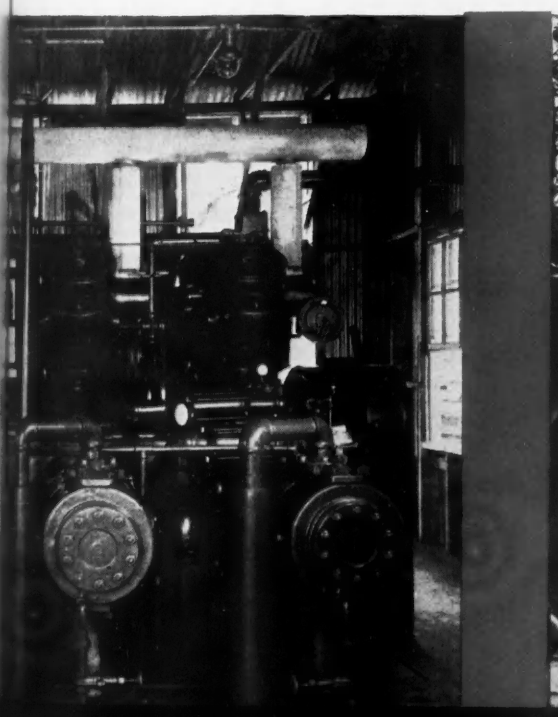
Sold Internationally by

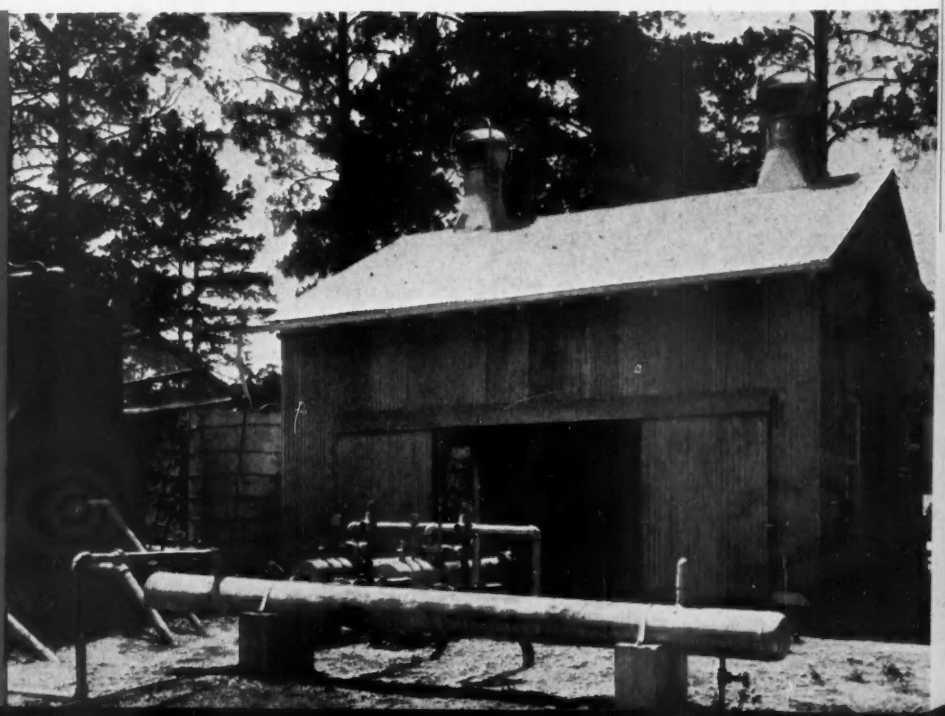
WILSON SUPPLY COMPANY

1412 MAURY ST., HOUSTON, TEXAS

SALES OFFICES: Tulsa, Oklahoma; Dallas and San Antonio, Texas. LOS ANGELES: Western Pressure Control, 5700 Santa Fe Avenue. TRINIDAD, B.W.I.: Neal Massey Eng. Corp.

BRANCH STORES: TEXAS: Kilgore, Beaumont, Barbers Hill, Bay City, Monahans, Alice, Victoria, Corpus Christi, Columbus. LOUISIANA—Lake Charles, New Iberia, Harvey, Shreveport. ARKANSAS—Magnolia. MISSISSIPPI—Natchez.





Con., Kenneth Murchison, C. V. Lyman, L. M. Morgan Oil Co., P.H.M. Co., Margaret Staniforth. **Remarks:** Little development and production prior to 1945, due to crude market being restricted to take care of small skimming unit at Post. Regular tank car shipments to Canadian and, later, Kansas refineries enabled operators to proceed with development, which has been substantial this year, and which recently increased in anticipation of entry of Stanolind with a direct trunk line

JUSTICEBURG

Discovery Data: Surface geology. **Discovery Well:** Emerald Oil Co.'s (was B. V. Blackwell et al) J. M. Boren 1, NW¼ 136, Blk 5, H&GN Ry Sur, May, 1926. **Type of Structure:** Anticline. **Producing Formations:** Permian sandy lime 2505-2573 ft, average 31 ft penetration. **Productive Area:** 80 acres. **Production June 30, 1947:** Cumulative 105,000 bbls (approx). Estimated remaining reserves: Dormant. **Producing Wells June 30, 1947:** 2 pumpers (dormant). **Gravity:** 38. **Deepest Test:** Emerald Oil's J. M. Boren 3, C NW NE H&GN 136, Blk 5, 1st sulfur water 3000-05 ft, td 4801 ft, pb and completed regular zone. **Oil Outlets:** Tank car and trucks. **Principal Leaseholders:** Emerald. **Remarks:** Discovery well located 1 mile east of previous drilled location which had show at 2015-25 ft.

P. H. D.

Discovery Data: Geology. **Discovery Well:** Honolulu-Devonian Oil's D. R. Payton 1, C SW SE TT Ry 1421, A-347, completed August 19, 1944. **Type of Structure:** Anticline. **Producing Formations:** San Andres 3390 to 3563 ft, averaging 100 ft of broken pay. **Producing Area:** Developed: 320 acres. **Production June 30, 1947:** Daily: 496 bbls (base allowable). Cumulative: 82,411 bbls. Estimated remaining reserves: 1,818,000 bbls. **Producing Wells June 30, 1947:** 8 pumping. **Gravity:** 35.2-38. **Rigs Running June 30, 1947:** None. **Deepest Test:** Honolulu-Devonian's Altman 1, 740 ft out of SEc TT Ry 1255, A-342, failure in granite at 9593-9604 ft; topped barren Ellenburger at 9170 ft. **Oil Outlets:** Trucks, Stanolind P. L. connection pending. **Principal Leaseholders:** Honolulu-Devonian, Plymouth. **Remarks:** Field made up of 3 separate producing areas, extending east-west 4 miles. Failures around each exceed the producers in numbers. However, all producers make their top allowable and more development probable when pipe line outlet becomes available.

SWENSON

Discovery Data: Geology. **Discovery Well:** Gulf's Swenson 1-B, C NW H&GN 25, Blk 2, completed December 2, 1938. **Type of Structure:** Anticline. **Producing Formations:** Basal Pennsylvanian 7327-34 ft. **Producing Area:** 40 acres. **Production June 30, 1947:** Cumulative: 1321 bbls. Estimated remaining reserves: Depleted. **Gravity:** 36.7. **Deepest Test:** Discovery plugged back from granite at 8104 ft, with Ellenburger at 7888-8085 ft. **Remarks:** Renewed explorations considered remote.

GLASSCOCK

CARTER

Discovery Data: Geology. **Discovery Well:** Floyd C. Dodson-B. A. Duffy's Carter 1, SW SW SW T&P 8, Blk 33, T-3-S, completed October 8, 1936. **Type of Structure:** Anticline. **Producing Formations:** San Andres 2632 to 2668 ft. **Producing Area:** 80 acres. **Production June 30, 1947:** Daily 9 bbls. Cumulative: 31,519 bbls. Estimated remaining reserves: Negligible. **Producing Wells June 30, 1947:** 1 pumping. **Gravity:** 29-32. **Rigs Runnings June 30, 1947:** None. **Deepest Test:** Fleetborn Oil Corp.'s Black Arrow 1, NE NE NE T&P 13, Blk 34, T-3-S, failure at 3002 ft. **Oil Outlets:** Trucks. **Principal Leaseholders:** Discoverers. **Remarks:** No further development of regular Permian anticipated.

GARDEN CITY

Discovery Data: Geophysics. **Discovery Well:** Shell's L. C. Clark 1, C NE SW T&P Ry, 5, Blk 32, T-4-S, completed October 18, 1946. **Type of Sstructure:** Anticline. **Producing Formations:** Mississippi lime at 9740-55 ft, involving 15 ft zone of perforations in lower section. **Producing Area:** 40 acres. **Production June 30, 1947:** Daily: 92 bbls. Cumulative: 15,540 bbls. Estimated remaining reserves: 305,000 bbls. **Producing Wells June 30, 1947:** 1 flowing. **Gravity** 56.5. **Rigs Running June 30, 1947:** None. **Deepest Test:** Discovery plugged back from granite at 10,964-70 ft; topped Ellenburger at 9838 ft and Hickory sand at 10,950 ft. **Oil Outlets:** Shell. **Principal Leaseholders:** Shell. **Remarks:** Only Mississippian producer in southeast sector of basin; more development assured; extent of productive area speculative.

WORLD—McDOWELL

Discovery Data: Subsurface geology. **Discovery Well:** Letwin-Lippett and Kallison's (was World Oil) McDowell, 1-C, NW SW NE T&P 21, Blk 34, T-2-S, May 4, 1929. **Type of Structure:** Anticline. **Producing Formations:** Permian limestone 2340-2430 ft, average 22-ft penetration. **Producing Area:** 100 acres. **Production June 30, 1947:** Daily: (Incorporated with Howard-Glasscock District). **Producing Wells June 30, 1947:** 5 pumping. **Gravity:** 26-28. **Rigs Runnings June 30, 1947:** None. **Deepest Test:** John I. Moore-Loffland Bros.' McDowell 1, C SE NE T&P 22, Blk 34, T-2-S, abnd in Ellenburger 10,470-906 ft, with rated flow of 17,000 B/D sulfur water. **Oil Outlets:** Cosden. **Principal Leaseholders:** Letwin, Lippett & Kallison, Loffland Bros. Co.-John I. Moore. **Remarks:** Production data under Howard-Glasscock District. Nine wells completed as producers in defining area; 5 remain as commercial pumpers.

HALE

PETERSBURG

Discovery Data: Geology-geophysics. **Discovery Well:** Stanolind's E. L. Fisher 1, 1210 ft nsl, 860 ft ewl EL&RR 5, Blk C-L, completed 1, 1947. **Type of Structure:** Anticline. **Producing Formations:** Upper Cisco (Pennsylvanian) 6895 to 6992 ft, involving 97 ft of broken pay. **Producing Area:** 40 acres. **Production June 30, 1947:** Daily: 140 bbls. Cumulative: 19,200 bbls. Estimated remaining reserves: 221,000 bbls. **Producing Wells June 30, 1947:** 1 flowing. **Gravity** 39. **Rigs Running June 30, 1947:** 1. **Deepest Test:** Stanolind's stine 1, 660 ft nsl and 1958 ft wel of N½ EL&RR 6, Blk C-L, ¾ mi NW discovery, abandoned in Pennsylvanian at 7528 ft. **Oil Outlets:** Stanolind. **Principal Leaseholders:** Stanolind. **Remarks:** Failures to SE, W, NW indicate unusually small producing area, although discovery flowed 1342 bbls natural through 28/64-inch choke. Nearest production from this zone 93 miles east in Foard County.

IRISH

Discovery Data: Geology-geophysics. **Discovery Well:** Stanolind's Lee Irish 1, C NE NE HE&WT Ry 18, Blk D-T, completed May 3, 1946. **Type of Structure:** Anticline. **Producing Formations:** Basal Clear Fork 5470 to 6027 ft, averaging 316 ft broken lime pay. **Producing Area:** 520 acres. **Production June 30, 1947:** Daily: 1300 bbls. Cumulative: 136,674 bbls. Estimated remaining reserves: 3,763,000 bbls. **Producing Wells June 30, 1947:** 13. (flowing 3; artificial lift 10). **Gravity:** 31-33. **Rigs Running June 30, 1947:** 4. **Deepest Test:** Glen J. Smith et al's Durrett-Stanolind 1, C SE NW HE&WT Ry 7, Blk D-T, 1⅝ mi NW production, failure in Clear Fork at 6504 ft. **Oil Outlets:** Stanolind. **Principal Leaseholders:** Anton Oil Corp., Gulf, Pure, Stanolind. **Remarks:** Producing area due to be united with Anton field to the west. No failures within or adjacent to the field.

HOCKLEY

LEVELLAND

Discovery Data: Geophysics. **Discovery Well:** Texas Co.'s L.Y.P. Montgomery 1, 580 ft out of NEc Labor 19, League 70, Val Verde CSL, completed February 23, 1945. **Type of Structure:** Anticline. **Producing Formations:** San Andres lime at 4741-4841, average 100-ft penetration. **Producing Area:** Developed, 3400 acres. **Production June 30, 1947:** Daily: 2048 bbls. Cumulative: 307,549 bbls. Estimated remaining reserves: 13,292,000 bbls (developed). **Producing Wells, June 30, 1947:** 80 (flowing: 62; artificial lift: 18). **Gravity:** 31-32. **Rigs Running June 30, 1947:** 17. **Deepest Test:** Cascade Pet Co.'s Stone 1, 660 ft out of SWc Labor 23, League 730, SCL, northeast outpost, failure in San Andres at 3970-5200 ft. **Oil Outlets:** South Plains P.L. Co. to local refinery and Stanolind. **Principal Leaseholders:** Anderson-Prichard, Seaboard, Stanolind, Texas Co., Texas Pacific Coal and Oil. **Remarks:** productive area will be more than doubled, trending west by south of main field towards northwest portion of Slaughter district. Large semi-proved area in extreme west, or original portion of field, yields sub-marginal pumpers.

SMYER

Discovery Data: Geophysics. **Discovery Well:** Woodley Pet.'s L. A. Harless-Stanolind 1, C NW NW Sect 21 Blk A, R. M. Thompson Sur, completed January 14, 1944. **Type of Structure:** Anticline. **Producing Formations:** Clear Fork 5830 to 5985 ft, averaging 121 ft broken lime pay. **Productive Area:** Developed: 120 acres. **Production June 30, 1947:** Daily: 75 bbls. Cumulative: 77,150 bbls. Estimated remaining reserves: 403,000 bbls. **Producing Wells June 30, 1947:** 3 pumping. **Gravity:** 26. **Rigs Running June 30, 1947:** None. **Deepest Test:** Discovery plugged back from 6000 ft. **Oil Outlets:** Trucks. **Principal Leaseholders:** Phillips, Stanolind, Woodley. **Remarks:** Small initial pumping yield per well discourages continued development.

YELLOWHOUSE

Discovery Data: Geology. **Discovery Well:** Stanolind's Tom Cobb 1, 660 ft out SEc of Labor 103-E, League 75, Haskell CSL, completed April 18, 1944. **Type of Structure:** Anticline. **Producing Formations:** San Andres 4549 to 4673 ft, averaging 59 ft broken lime pay. **Productive Area:** Developed: 240 acres. **Production June 30, 1947:** Daily: 144 bbls. Cumulative: 123,303 bbls. Estimated remaining reserves: 837,000 bbls. **Producing Wells June 30, 1947:** 6 pumping. **Gravity:** 30-32. **Rigs Running June 30, 1947:** 2. **Deepest Test:** Discovery plugged back from 4685 ft. **Oil Outlets:** Stanolind. **Principal Leaseholders:** Stanolind controls area. **Remarks:** Production involves 2 areas 2¼ miles apart, and will be expanded into a large area, although crude yield per acre subnormal considering depth. Deeper pays are speculative. Development held back until completion of pipe line outlet this year.

HOWARD-GLASSCOCK

HOWARD-GLASSCOCK

Location: A group of fields centering upon Howard-Glasscock County line. Embraces an elongated area trending NE-SW measuring some 25 miles long by three miles wide at its widest part. Included in the area are the following fields: World-McDowell, Chalk, Clay-Hyer, Hyman, Roberts, and Settles-Henshaw. Settles (Shallow) field is discussed separately. **Discovery Data:** See individual field descriptions. **Discovery Well:** See individual field descriptions. **Type of Structure:** Anticlines. **Producing Formations:** See individual field descriptions. **Producing Area:** Five zones (1400-3000 ft) having a total producing area of 18,500 acres. **Production June 30, 1947:** Daily: 13,345 bbls. Cumulative: 122,748,704 bbls. Estimated remaining Reserves: 65 million. **Producing Wells June 30, 1947:** Total: 880 (pumping). **Gravity:** 26-33. **Rigs Running June 30, 1947:** 4. **Deepest Test:** Continental Oil-Group One Oil's W. R. Settles 1-D-33, SE NW NW W&NW Ry, Blk 29, failure in Ellenburger 9904-10,122 ft. **Oil Outlets:** Cosden, ColTex, Shell. **Principal Leaseholders:** Amerada, American Maracaibo, Basin Oil, Otis Chalk, Cities Service, Continental, Continental Group One, Cosden, M. E. Daniel, Eastland, George Farley, Fleming Oil, Gulf, Helmerich, & Payne, Humble, Fred Hyer, Imperial Oil, Johnson & Bruce, Kenwood Oil, Lamb Prod., Lion Oil, Lynch Oil, Magnolia, M&M Prod., Phillips, Plymouth, Pure, Royal Oil and Gas, Samedan, Schermerhorn, Shell, Standard, Sun, Stanolind, Sunray, Tide Water **Remarks:** Multiple oil pays prevail in some of the fields, resulting in an overlap that required consolidation. Settles (shallow) field is processed separately as an example of production ability. Both deepening and plug back operations will continue for years in the multiple-pay areas.

HOWARD

CHALK, (INCLUDED WITH HOWARD-GLASSCOCK)

Discovery Data: Geology, random drilling. **Discovery Well:** Magnolia's (was Owens-Sloan et al) Otis Chalk 1-A, SEc NE W&NW 113, Blk 29, April 18, 1926. **Type of Structure:** Anticline. **Producing Formations:** Seven Rivers 1545-1915 ft, average 23 ft penetration. **Remarks:** Production data under Howard-Glasscock District. Development of this sector lately resumed by Magnolia; new wells make top allowable daily.

CLAY HYER, (INCLUDED WITH HOWARD-GLASSCOCK)

Discovery Data: Random drilling. **Discovery Well:** Continental's (was Fred Hyer) H. R. Clay 1, NW SE SW W&NW Ry 139, Blk 29, completed November 20, 1925, as first well in what later became Howard-Glasscock field. **Type of Structure:** Anticline. **Producing Formations:** Yates 1750 to 1900 ft, averaging 21 ft penetration. **Remarks:** This discovery was forerunner of a series of strikes at varying depths that have been joined to be later classified as Howard-Glasscock field, which extends generally east-west for 20 miles. Production data carried under Howard-Glasscock. This discovery still pumps 5 barrels daily.

FAIRVIEW

Discovery Data: Geology. **Discovery Well:** Bruce Clardy's Fee 1, C SW SW T&P Ry 4, Blk 33, T-1-N, completed December 19, 1945. **Type of Structure:** Anticline. **Producing Formations:** San Andres 3100-40 ft, being 40 ft of sparsely oil-saturated lime. **Producing Area:** 40 acres. **Production June 30, 1947:** Daily: Depleted. Cumulative: 910 bbls. Estimated remaining reserves: None. **Gravity:** 28.2. **Deepest Test:** Discovery plugged back from 3560 ft. **Remarks:** Discovery declined to non-commercial production, and plugged February, 1946. west offset was failure. Revival of development unlikely.

Baroid

leader
in the development of
drilling mud products
and their
applications

Pages
433-476

see the Baroid section

Baroid Sales Division
NATIONAL LEAD COMPANY

BAROID SALES OFFICES: LOS ANGELES 12 • TULSA 3 • HOUSTON 2

HOWARD-GLASSCOCK DEEP

Discovery Data: Geology. **Discovery Well:** Continental-Group One Oil's W. R. Settles 1-D-133, SE NW NW W&NW Ry, Blk 29, completed January 30, 1946. **Type of Structure:** Anticline. **Producing Formations:** Pennsylvania lime (Crinoidal) from 8924-9080 ft. **Producing Area:** 40 acres. **Production June 30, 1947:** Daily: Not commercial. Cumulative: 10,013 bbls. Estimated remaining reserves: None. **Gravity:** 40.6. **Rigs Running June 30, 1947:** None. **Deepest Test:** Discovery well failed in Ellenburger 9904-10,122 ft and plugged back for completion in Crinoidal. **Remarks:** Discovery pumped initial 31 bbls, then declined sharply and plugged back to regular pay.

HYMAN (INCLUDED WITH HOWARD-GLASSCOCK)

Discovery Data: Trend drilling. **Discovery Well:** Magnolia's Harry Hyman 2, 100 ft s of C SE¼ W&NW 88 Blk 29, June 27, 1929. **Type of Structure:** Anticline. **Producing Formations:** Yates sand 1290-1325 ft, average 10 ft penetration. **Remarks:** Production data under Howard-Glasscock District. Ten producers completed in this sector, most easterly of the group of fields.

IATAN NORTH

Discovery Data: Geology. **Discovery Well:** Ray Oil Co.'s W. R. Read A-1, SE SE SE Sect 37, Blk 30, T&P Ry, T-1-N, completed July 22, 1942. **Type of Structure:** Anticline. **Producing Formations:** Clear Fork (Permian), 2634-3000 ft, average 151 ft penetration. **Producing Area:** 640 acres. **Production June 30, 1947:** Daily: 169 bbls. Cumulative: 265,558 bbls. Estimated remaining reserves: 225,000 bbls. **Producing Wells June 30, 1947:** 14 pumping. **Gravity:** 29-37. **Deepest Test:** Cosden's W. R. Read B-4, NW NW SE T&P Ry 48, Blk 30, T-1-S, failure in Clear Fork at 4246 ft. **Oil Outlets:** Cosden, Col-Tex. **Principal Leaseholders:** Cosden, Ray Oil. **Remarks:** Outlined by failures, except short interval separating field from Iatan-East Howard field.

MOORE

Discovery Data: Subsurface, projected productive trend. **Discovery Well:** Continental-Group One Oil Corp.'s (was Marland Oil Co. et al) Harding 1, C SE T&P 19, Blk 33, T-1-S, June 12, 1927. **Type of Structure:** Anticline. **Producing Formations:** San Andres lime (Perm) 3066-3277 ft, average 52 ft penetration. **Producing Area:** Developed: 720 acres (scattered). **Production June 30, 1947:** Daily: 65 bbls. Cumulative 197,807 bbls. Estimated remaining reserves: 100,000 bbls. **Producing Wells June 30, 1947:** 17 pumping. **Gravity:** 27-29.2. **Deepest Test:** Stanolind's T. H. Gaskins 1, C NW SE Sect 7, Blk 33, T&P Ry, T-1-S, failure in Ellenburger 10,315-366 ft. **Oil Outlets:** Cosden. **Principal Leaseholders:** Continental-Group One, Moore Explor., Stanolind, M. E. Daniel et al. **Remarks:** All completions registered small initial output, but have long pumping life. The elimination of deeper pay prospects by Ellenburger failure will result in abandonment of sub-marginal leases.

MORITA

Discovery Data: Geology. **Discovery Well:** Stanolind's (was J. B. Hawley, Jr.-Northern Ordnance) J. W. Cook 1, C SE NW T&P Ry 23, Blk 34, T-1-N. **Type of Structure:** Anticline. **Producing Formations:** San Andres (Perm) 3150-3290 ft, average 74 ft penetration. **Productive Area:** Developed: 120 acres (scattered). **Production June 30, 1947:** Daily: 5 bbls. Cumulative 8258 bbls. Estimated remaining reserves: Negligible. **Producing Wells June 30, 1947:** 3 pumping. **Gravity** 25.4-29. **Deepest Test:** Discovery plugged back from 3516 ft in San Andres. **Oil Outlets:** Cosden. **Principal Leaseholders:** Stanolind. **Remarks:** Output of individual wells does not warrant further development.

ROBERTS (INCLUDED WITH HOWARD-GLASSCOCK)

Discovery Data: Geology. **Discovery Well:** Magnolia's Dora Roberts 1, SE SE SW W&NW 136, Blk 29, October 24, 1927, from Clear Fork at 2956-90 ft. **Type of Structure:** Anticline. **Producing Formations:** Clear Fork 2940-3100 ft, average 15 ft penetration. Permian sandy lime 2310-2600 feet, average 116 ft penetration. Permian (Yates) sand 1325-1450 ft, average 60 ft penetration. **Gravity:** 27-29. **Remarks:** Production data under Howard-Glasscock District. This discovery established the deepest and most prolific oil wells in the area, and is currently producing its base allowable of 20 barrels daily.

SETTLES-HENSHAW (INCLUDED WITH HOWARD-GLASSCOCK)

Discovery Data: Geology. **Discovery Well:** American-Maracaibo Co.'s (was Henshaw Oil Corp.) W. R. Settles 1-A NW SE NW T&P 6, Blk 32, T-2-S, August 7, 1928. **Type of Structure:** Anticline. **Producing Formations:** Graysburg lime at 2060-2540 feet, average 57 ft penetration. **Gravity:** 32-33. **Remarks:** Production data under Howard-Glasscock District.

SETTLES SHALLOW

Discovery Data: Geology. **Discovery Well:** Continental-Group One Oil Corp.'s (was Marland & Texon) W. R. Settles 1-S, C SW W&NW 159, Blk 29, March 8, 1927. **Type of Structure:** Anticline. **Producing Formations:** Yates 1201-1315 ft, average 36 ft penetration. **Producing Area:** 370 acres. **Production June 30, 1947:** Daily: 585 bbls (base allowable). Cumulative: 2,563,743 bbls. Estimated remaining reserves: 2,986,000 bbls. **Producing Wells June 30, 1947:** 37 pumping. **Gravity:** 32-34. **Rigs Running June 30, 1947:** None. **Deepest Test:** Discovery deepened in 1928 to water at 3504 ft, recompleted in original pay as 280-barrel pumper. **Oil Outlets:** Cosden P.L. **Principal Leaseholders:** Discoverers own entire field. **Remarks:** This shallow pool within Howard-Glasscock field has accounted for 37 wells without a failure. Development discontinued August, 1937. All but last completion make top allowable production. Field has averaged 69,290 bbls per well and 6929 bbls per acre.

SNYDER

Discovery Data: Geology. **Discovery Well:** Magnolia's (was Choate-Henshaw) M. H. O'Daniel 1, C SE T&P 34, Blk 30, T-1-S, May 12, 1926. **Type of Structure:** Anticline. **Producing Formations:** Glorietta 2560-2900 ft, average 200 ft penetration. **Productive Area:** Developed: 1100 acres. **Production June 30, 1947:** Daily: 535 bbls. Cumulative: 3,193,898 bbls. Estimated remaining reserves: 1,206,000 bbls. **Producing Wells June 30, 1947:** 106 pumping (4 wells depleted). **Gravity:** 30-31. **Rigs Running June 30, 1947:** None. **Deepest Test:** Magnolia's M. H. O'Daniel 1, NW NE NW T&P 40, Blk 30, T-1-S, abandoned at 3750 ft. **Oil Outlets:** Col-Tex, Cosden. **Principal Leaseholders:** Magnolia, Eastland Ambassador & White, Fleming Oil Co., C. T. McLaughlin, Moore Expl., Shell, Sun, Westex Oil, J. W. Murchison, Stanolind, Texas Co. **Remarks:** Majority of leases approaching depletion stage, as 93 wells have declined to marginal and stripper-well status. Area not explored below Clear Fork.

VINCENT

Discovery Data: Geology. **Discovery Well:** W. S. Guthrie-Cosden's P. Allen 1, C SE SE L. N. Co. 57, Blk 20, completed May 29, 1943, field discovery in Clear Fork. W. S. Guthrie-Cosden's P. Allen 2, C NW SE L. N. Co. 57, Blk 20, completed April 25, 1944, discovery of the Wichita-Albany-pay zone. **Type of Structure:** Anticline. **Producing Formations:** Clear Fork 4028 to 4310 ft; 2 wells, averaging 64 ft of broken lime pay. Wichita-Albany 5451 to 5502 ft; 1 well, involving 51 ft of broken lime pay. **Production June 30, 1947:** Daily: 7 bbls. Cumulative: 25,362 bbls (both zones). Estimated remaining reserves: Negligible. **Producing Wells June 30, 1947:** 3 pumping. **Gravity:** Clear Fork 27-28; Wichita-Albany 33.6. **Rigs Runnings June 30, 1947:** 1. **Deepest Test:** Guthrie-Cosden's Allen 2, failure in Wolfcamp at 6172 ft; plugged back to Wichita-Albany. **Oil Outlets:** Trucks. **Principal Leaseholders:** W. S. Guthrie & Cosden, Coffield & Guthrie. **Remarks:** Further development of Permian doubtful.

IRION

TANKERSLEY

Discovery Data: Geology-geophysics. **Discovery Well:** Shell's Tankersley 2, C SW SW GC&SF 10, completed July 13, 1945. **Type of Structure:** Anticline. **Producing Formations:** Strawn (Pennsylvanian) lime 7192 to 7203 ft, averaging 8 ft pay. **Producing Area:** 80 acres. **Production June 30, 1947:** Daily: 110 bbls. Cumulative 45,735 bbls. Estimated remaining reserves: 194,000 bbls. **Producing Wells June 30, 1947:** 2 pumping. **Gravity:** 45.4-47. **Rigs Running June 30, 1947:** None. **Deepest Test:** Discovery drilled to Hickory (Cambrian) sand 8364-8408 ft and pb. **Oil Outlets:** Trucks. **Principal Leaseholders:** Shell. **Remarks:** Not profitable; deeper pay prospect eliminated for immediate vicinity of production.

MERTZON

Discovery Data: Geology. **Discovery Well:** Irion Oil Co.'s (was R. E. Moore & M. Kennedy) F. Tankersley 1, completed July 22, 1928. **Type of Structure:** Anticline. **Producing Formations:** Glorietta 1340 to 1475 ft, averaging 5 ft of lime pay. **Producing Area:** 220 acres. **Production June 30, 1947:** Daily: 18 bbls. Cumulative: 171,065 bbls. Estimated remaining reserves: Negligible. **Producing Wells June 30, 1947:** 6 pumping. **Gravity:** 37-38. **Rigs Running June 30, 1947:** None. **Deepest Test:** F. E. Webb's Nutt 1, SEc N½ Blk 8, Gonzales CSL, failure at 3511 ft. **Oil Outlets:** Trucks. **Principal Leaseholders:** Oscar Donley et al. **Remarks:** Most of properties in field have changed ownership frequently. Productive leases located some distance from the original discovery.

KENT

POLAR

Discovery Data: Geophysics. **Discovery Well:** Humble's Lida Vick 1, C NW NE H&GN Ry 45, Blk 5, completed May 1, 1946. **Type of Structure:** Anticline. **Producing Formations:** Ellenburger 7775 to 7825 ft, averaging 28 ft of pay. **Producing Area:** Developed: 120 acres. **Production June 30, 1947:** Daily: 235 bbls. Cumulative 50,108 bbls. Estimated remaining reserves: 670,000 bbls. **Producing Wells June 30, 1947:** 3 (flowing 1, artificial lift 2). **Gravity:** 38.6-40.9. **Rigs Runnings June 30, 1947:** None. **Deepest Test:** Humble's Moore-Treet 1, ½ mi west of discovery, failure in Ellenburger at 7840-7978 ft. **Oil Outlets:** Trucks. **Principal Leaseholders:** Humble. **Remarks:** Virtually defined by failures and low wells; 2 of completed wells are marginal producers, including a noncommercial pumper.

LAMB

ANTON

Discovery Data: Geophysics. **Discovery Well:** Anton Oil Corp.'s (was Humble) J. A. Jackson 1, C NE NW Sect 119, Blk A, R. M. Thomson Sur, completed December 21, 1944. **Type of Structure:** Anticline. **Producing Formation:** Clear Fork 5348 to 6014 ft, averaging 314 ft of broken lime pay. **Producing Area:** 280 acres. **Production June 30, 1947:** Daily: 465 bbls. Cumulative 189,221 bbls. Estimated remaining reserves: 1,210,000 bbls. **Producing Wells June 30, 1947:** 7 pumping. **Gravity:** 27.5-32.4. **Rigs Running June 30, 1947:** 2. **Deepest Test:** Humble's Campbell 1, C NE NW Sect 116, Blk A, R. M. Thomson Sur, Hockley County, mile south of discovery, failure in granite at 11,725-11,730 ft, topped 190-ft section barren Ellenburger at 11,410 ft. **Oil Outlet:** Stanolind. **Principal Leaseholders:** Anton Oil Corp., Caroline Hunt Tr. Est., Stanolind. **Remarks:** Producing area due to be expanded eastward to unite with the Irish field, Hale County. Humble controlled bulk of producing area and disposed of entire holdings due to comparatively low crude yield per acre and elimination of deeper pays.

LOVING

MASON

Discovery Data: Subsurface geology. **Discovery Well:** Loving County Oil Co.'s (was Michigan O & G Co.-Mason Oil Co.) Kyle 2, SWc NE T&P 20, Blk 55, Tsp 1, January 20, 1937. **Type of Structure:** Anticlinal nosing. **Producing Formations:** Delaware 3880-3991 ft, average 46 ft penetration. **Producing Area:** 320 acres. **Production June 30, 1947:** Daily: 136 bbls. Cumulative: 726,184 bbls. Estimated remaining reserves: 242,000 bbls. **Producing Wells June 30, 1947:** 8 (flowing 2, artificial lift). **Gravity** 38.9. **Rigs Running June 30, 1947:** None. **Deepest Test:** Argo Oil's TXL 1-B, NW NW NW T&P Ry 21, Blk 55, Tsp 1, failure in Delaware at 4165 ft. **Oil Outlets:** Mason P. L. Co. to Pasotex P. L. **Principal Leaseholders:** Argo Oil, Helmerich and Payne, R. A. Westbrook, Woodley Pet. **Remarks:** Failures and small production discount possibility of further development.

WHEAT

Discovery Data: Drilled on strength of production showing made by Toyah-Bell Oil Co.'s L. B. Russell 1, Sect 80 which began flowing by heads 9-21-21 at 4270 ft, but was junked, 1921. **Discovery Well:** Lockhart & Co.'s (was P. V. Pet. Co.) J. J. Wheat 1, 150 ft from e l and 1187 ft from s l W&NW 82 Blk 1, September 1, 1925. **Type of Structure:** Anticlinal nosing. **Producing Formations:** Delaware 4160-4390 ft, average 26 ft penetration. **Productive Area:** 3600 acres (developed). **Production June 30, 1947:** Daily: 733 bbls. Cumulative: 10,254,629 bbls. Estimated remaining reserves: 2,500,000 bbls. **Producing Wells June 30, 1947:** 79 (flowing: 20; artificial lift: 9). **Gravity:** 38-39. **Rigs Runnings June 30, 1947:** None. **Deepest Test:** Lockhart & Co.'s Wheat 1-H, 990 ft from nel and sel H&TC Ry 85, Blk 33, failure in Delaware 5078 ft. **Oil Outlets:** Pasotex. **Principal Leaseholders:** Sinclair Prairie, Intercoast Pet., Standard of Texas. **Remarks:** Wheat is the first important oil development of the Delaware Mountain zone in the district. Previous exploratory work in Reeves County yielded limited quantities of oil from this horizon, but production was not maintained. Completions in Wheat field flow for an exceptionally long period. Pre-Permian exploration indefinitely deferred due to excessive depths involved.

LUBBOCK

CRAVENS

Discovery Data: Geology. **Discovery Well:** Seaboard-Stanolind's L. M. Cravens 1, C SW SW L&SV Ry 16, Blk D, completed February 28, 1945. **Type of Structure:** Anticline. **Producing Formations:** Clear Fork 6050 to 6166 ft, involving 116 ft of broken lime pay. **Pro-**

Saturday Night....

.... or Any Other Night

MID-CONTINENT STORES

are Ready to Supply You!

Years of experience have shown us that when you need supplies you need them, and time is the important factor. That is why on Saturday night or any other night Mid-Continent's experienced men are ready to supply you from completely stocked and conveniently located stores.

MID-CONTINENT
Supply Company

General Offices Mid-Continent Bldg. **FORT WORTH, TEXAS**

- DIVISION OFFICE: Houston, Midland, Shreveport, Tulsa
- DISTRICT OFFICES: TEXAS: Corpus Christi, Dallas, Kermit, Kilgore, Odessa, San Antonio, Wichita Falls; COLORADO: Denver; CALIFORNIA: Los Angeles; LOUISIANA: New Orleans; NEW YORK: New York City; OKLAHOMA: Oklahoma City; MISSISSIPPI: Natchez; KANSAS: Wichita.
- BRANCH STORES: TEXAS: Bowie, Falfurrias, Fullerton (Andrews County), Gainesville, Houston, Kermit, Kilgore, Odessa, Refugio, Sundown, Wichita Falls; LOUISIANA: Houma, Lake Charles, New Iberia, Shreveport; MISSISSIPPI: Brookhaven, Laurel, Natchez; OKLAHOMA: Edmond, Pauls Valley; NEW MEXICO: Eunice, Hobbs; ARKANSAS: Magnolia; COLORADO: Rangely; KANSAS: Great Bend.

ducing Area: Developed: 40 acres. **Production June 30, 1947:** Daily: Inactive. Cumulative: 4055 bbls. Estimated remaining reserves: 120,000 bbls. **Producing Wells June 30, 1947:** 1 pumping. **Gravity:** 24. **Rigs Runnings June 30, 1947:** None. **Deepest Test:** Discovery plugged back from black shale (Permian) at 8800 ft. **Oil Outlets:** Trucks. **Principal Leaseholders:** Discoverers. **Remarks:** Discovery has been inactive for months due to isolation from pipe line, but will be restored to pumping; more drilling due.

LUBBOCK

Discovery Data: Geology. **Discovery Well:** W. G. Nairn Est's (was L. C. Harrison) Nairn Est. 1, C SE SE Sect 25, Blk A, J. H. Gibson Sur, August 20, 1941. **Type of Structure:** Anticline. **Producing Formations:** Glorietta 4870 to 5002 ft, involving 132 ft of broken lime pay. **Producing Area:** 40 acres. **Production June 30, 1947:** Daily: 15 bbls. Cumulative 34,586 bbls. Estimated remaining reserves: Unimportant. **Producing Wells June 30, 1947:** 1 pumping. **Gravity:** 28. **Rigs Running June 30, 1947:** None. **Deepest Test:** Seaboard-T. P. Coal & Oil's Nairn 2, C NW NW Sect 25, Blk A, J. H. Gibson Sur, 1 m NW of discovery, failure in Clear Fork at 6390 ft. **Oil Outlet:** Trucks. **Remarks:** Small pumping output and isolation from market have discouraged further development, which will revive later on moderate basis.

STENNETT

Discovery Data: Geology. **Discovery Well:** Stanolind's J. F. Stennett 1, 660 ft out of SWc Labor 18, League 4, San Augustine CSL, completed August 1, 1942. **Type of Structure:** Anticline. **Producing Formations:** Glorietta 4685 to 4767 ft, involving 82 ft of broken lime pay. **Productive Area:** Developed: 40 acres. **Production June 30, 1947:** Cumulative: Shut in for market outlet. Estimated remaining reserves: Inactive. **Producing Wells June 30, 1947:** 1 pumping. **Gravity:** 26.5. **Rigs Running June 30, 1947:** None. **Deepest Test:** Discovery plugged back from Clear Fork at 7000 ft. **Oil Outlets:** Trucks. **Principal Leaseholders:** Stanolind. **Remarks:** Discovery pumped 66 bbls of oil and 35 bbls of water initial, then capped due to isolation from pipe line and local refineries. Renewal of development indefinite.

MENARD

MORROW

Discovery Data: Geology. **Discovery Well:** Warren Pet.-Tevis F. Morrow's Russell 1, C NE NE Sect 18, S. Wallick (AB&M) Sur, A-1478, completed August 12, 1946. **Type of Structure:** Anticline. **Producing Formations:** Canyon (Pennsylvanian) 2282-90 feet. **Producing Area:** 40 acres. **Production June 30, 1947:** Daily: 3 bbls. Cumulative: 428 bbls. Estimated remaining reserves: Negligible. **Producing Wells June 30, 1947:** 1 pumping. **Gravity:** 32.5. **Rigs Running June 30, 1947:** None. **Deepest Test:** Warren & Morrow's Russell 2, 620 ft snl and 1980 ft wel Sect 18, S. Wallick (AB&M) Sur, A-1478, failure in Hickory at 4505-4585 ft; topped barren Ellenburger at 4162 ft. **Oil Outlets:** Trucks. **Principal Leaseholders:** Warren Pet., Tevis P. Morrow. **Remarks:** Recoverable oil per well not profitable.

MIDLAND

MIDLAND

Discovery Data: Geophysics. **Discovery Well:** Humble's O. P. Buchanan 1, 660 ft ewl and 1980 ft snl Wm. Baldridge Sur. 32, completed November 6, 1945. **Type of Structure:** Anticline. **Producing Formations:** Pennsylvania lime at 10,370-90 ft. **Producing Area:** Developed: 40 acres. **Production June 30, 1947:** Daily: 15 bbls. Cumulative: 21,402 bbls. Estimated remaining reserves: Unimportant. **Producing Wells June 30, 1947:** 1 pumping. **Gravity:** 45.7. **Rigs Running June 30, 1947:** None. **Deepest Test:** Discovery plugged back from Ellenburger at 12,170-574 ft. **Oil Outlets:** Trucks. **Principal Leaseholders:** Humble. **Remarks:** Unprofitable to continue development in view of small crude yield and depth.

MIDLAND SOUTH

Discovery Data: Geology-geophysics. **Discovery Well:** Humble's Mary Turner 1, 660 ft ewl and 1980 ft snl Sect. 43, W. T. Holcombe Sur., completed February 7, 1947. **Type of Structure:** Anticline. **Producing Formations:** Wolf Camp (Basal Permian) 8500-65 ft., involving 65 ft. of broken pay. **Producing Area:** Developed, 40 acres. **Production June 30, 1947:** Daily, 139 bbls.; Cumulative 5458 bbls. Estimated remaining reserves, 235,000 bbls. **Producing Well June 30, 1947:** 1 pumping. **Gravity:** 40. **Rigs Running June 30, 1947:** None. **Deepest Test:** Discovery plugged back from Devonian at 11,358-445 ft. **Oil Outlets:** Trucks. **Principal Leaseholders:** Humble. **Remarks:** Considering low crude yield per acre and depth, not profitable to continue development.

MITCHELL-HOWARD

IATAN-EAST HOWARD

Discovery Data: Trend drilling. **Discovery Well:** Magnolia's Mary Foster 1, SEc SW T&P 17, 29, T-1-S, August 18, 1925. **Type of Structure:** Anticline. **Producing Formations:** Clear Fork 2285-3005 ft, averaging 246 ft of broken lime pay, consisting of several beds. **Producing Area:** 8600 acres (scattered). **Production June 30, 1947:** Daily: 3675 bbls. Cumulative: 21,125,993 bbls. Estimated remaining reserves:: 43,374,000 bbls. **Producing Wells June 30, 1947:** Total: 401 (flowing: 2; pumping: 339). **Gravity:** 29-30. **Rigs Running June 30, 1947:** 3. **Deepest Test:** Magnolia's W. L. Foster 22, 2009 ft snl and 2006 ft ewl T&P 17, Blk 29, T-1-S, failure in Ellenburger 8415-73 ft. Plugged back to regular pay. **Oil Outlets:** Col-Tex, Cosden. **Principal Leaseholders:** E. J. Roeseke, Bond Oil Corp., Fleming Oil Co., Foster and Hayward, Magnolia, Mid-Continent, O. M. Murray, Producers Dev. Co., Sinclair Prairie, Standard of Texas, Stanolind. **Remarks:** Howard County sector largely drilled on 10-acre pattern. More development pending. Unusually large nitro shots employed due to inclusion of upper and lower pays in many wells.

MITCHELL

BRENNAND

Discovery Data: Geology. **Discovery Well:** Tobe Foster et al's R. S. Brennand-Standard of Texas 1, NE NE NE T&P Ry 4, Blk 28, T-1-N, completed May 20, 1947. **Type of Structure:** Anticline. **Producing Formations:** Clear Fork li at 2601-2775 ft, being 174 ft of broken pay. **Producing Area:** Developed: 40 acres. **Production June 30, 1947:** Daily: 55 bbls. Cumulative: New area. Estimated remaining reserves: Undetermined. **Producing Wells June 30, 1947:** 1 pumping. **Gravity:** 25.3. **Rigs Running June 30, 1947:** 1. **Deepest Test:** Discovery plugged back from 2885 ft. **Oil Outlets:** Trucks. **Principal Leaseholders:** Tobe Foster et al, Humble, O. B. Price, Standard of Texas. **Remarks:** Outlying failures will localize productive area.

COLEMAN RANCH

Discovery Data: Geology. **Discovery Well:** Norman and Roche's (was C. E. Beavers et al) S. R. Coleman 1, SE SE NW H&TC Ry 70, Blk 97, September 20, 1946. **Type of Structure:** Anticline. **Producing Formations:** Clear Fork lime from 2560-2916 ft, average 190 ft penetration. **Producing Area:** Developed: 380 acres. **Production June 30, 1947:** Daily: 331 bbls. Cumulative: 45,126 bbls. Estimated remaining reserves: 1,475,000 bbls. **Producing Wells June 30, 1947:** 19 pumping. **Gravity:** 24-25. **Rigs Running June 30, 1947:** 2. **Deepest Test:** Norman & Roche's Coleman 2-B, H&TC Blk 97, testing at 3290 ft. **Oil Outlets:** Coffield and Guthrie. **Principal Leaseholders:** Frank Buttram et al, Doswell & H. W. Snowden, Four "W" Oil Co., Tobe Foster et al, Norman & Roche. **Remarks:** Nearby failures tend to restrict production to small area.

WESTBROOK

Discovery Data: Random drilling. **Discovery Well:** Standard of Texas' (was Underwriters Prod. Co.) Abrams (TXL) 1, NWc T&P 33, Blk 28, T-1-N, completed October, 1920, field discovery, upper pay. Standard of Texas' (was Underwriters Prod Co.) Morrison 2, SW SE T&P 28, Blk 28, T-1-N, completed April 1, 1921, lower pay discovery. **Type of Structure:** Anticline. **Producing Formations:** Upper Clear Fork 2440-2500 ft. Middle Clear Fork 2800-3225 ft, averaging 184 ft of broken lime pay. **Producing Area:** 6200 acres (scattered). **Production June 30, 1947:** Daily: 1290 bbls. Cumulative: 13,267,291 bbls. Estimated remaining reserves: 4,422,500 bbls.

Producing Wells June 30, 1947: Total: 152 pumping; depleted: 74. **Gravity:** 22-24. **Rigs Running June 30, 1947:** None. **Deepest Test:** Col-Tex's Miller 1, NE NE NW T&P 22, Blk 28, T-1-N, failure in Ellenburger at 8050-8201 ft. **Oil Outlets:** Col-Tex. **Principal Leaseholders:** Anderson-Prichard, Col-Tex, Fulton & Markham, Hickok & Reynolds Magnolia, Morrison & Barber, Standard of Texas, C. L. Wann. **Remarks:** This field established first commercial oil production in Permian Basin. Upper pay comparatively short-lived, but some of original lower pay wells continue as profitable pumpers. No appreciable development until 1924; field work subsided late 30's, then revived on largest scale in 1944-45. Future development will be negligible.

PECOS-CROCKETT

TOBARG

Discovery Data: Production trend of Yates pool, and core drilling. **Discovery Well:** Cardinal Oil's Mrs. F. E. Tobarg 1, 341 ft out of SEc W½ Sect. 539, Arnold & Barrett Sur A-3, August 24, 1929. **Type of Structure:** Accumulative source on flank of Yates dome. **Producing Formations:** Cretaceous sandstone 320-600 ft, average 32 ft penetration. **Producing Area:** 2000 acres. **Production June 30, 1947:** Daily: 1508 bbls. Cumulative: 9,421,540 bbls. (including Yates field sector.) Estimated remaining reserves: 4,500,000 bbls (including Yates field sector). **Producing Wells June 30, 1947:** Total: 325 (flowing: 25; artificial lift: 300). **Gravity:** 18-26. **Rigs Running June 30, 1947:** 8. **Deepest Test:** Standard of Texas' Smith-Douglas 1, C SE SE GC&SF 9, Blk 194, west edge of production of Yates pool, failure in Ellenburger 8732-9114 ft. **Oil Outlets:** Shell, Humble, Gulf, Pasotex. **Principal Leaseholders:** Childress Roy. Co., Corvette Oil Corp., Gulf, Helmerich & Payne, Ohio, J. C. Roberts, A. J. Rife, Stanolind, Tide Water, Val Carroll Oil Co. **Remarks:** Tobarg field proper adjoins the Yates field on the northwest, yielding low gravity oil with an excellent lube content. Migratory oil, originating in the Yates field, due to defective casing, is produced on the north, northeast and east flanks at depths ranging down from "grass roots," and this oil is officially prorated as part of the Tobarg field. Development of both areas will remain active indefinitely due to close spacing.

PECOS-WARD

PAYTON

Discovery Data: Geology and trend. **Discovery Well:** British-American's (was J. J. Dorr) Payton 1, 660 ft ewl and 9217 ft nsl H&GN 99, Blk 8, completed December 8, 1937. **Type of Structure:** Anticline. **Producing Formations:** Yates 1920-2150 ft, averaging 63 ft of penetration. **Producing Area:** 1600 acres. **Production June 30, 1947:** Daily: 413 bbls. Cumulative: 3,899,244 bbls. Estimated remaining reserves: 2,501,000 bbls. **Producing Wells June 30, 1947:** Total: 118 (flowing: 7; artificial lift: 111). Depleted or inactive: 27. **Gravity:** 32-37. **Rigs Running June 30, 1947:** None. **Deepest Test:** Roeser & Pendleton's Johnson 2-8 330 ft from nw&swl of 200-ac lse, H&TC 8, Blk 34, failure in San Andres at 3198 ft. **Oil Outlets:** Atlantic. **Principal Leaseholders:** Brandor Pet. British-American, Buffington & Smith, Roy Burk Co., P. L. Crandall, Dalport Oil, Ja-Chel Oil, Hall & Walker, H. Jaffe, Jamison & Pollard, Luse & Ice, Roeser & Pendleton, C. C. Pollard. **Remarks:** Majority of wells have attained stripper-well status. No further development of regular pay.

PECOS VALLEY HIGH GRAVITY

Discovery Data: Random drilling. **Discovery Wells:** Original well not determined due to reclassification of Pecos Valley field to segregate low and high gravity areas. McCarthy Oil Co.'s (was Quinby Oil Co.) Bennett 2, C NW¼ GC&SF Ry 592, completed February, 1927, as discovery of Byrne sector, situated 6 miles south of other high gravity areas. Union Oil & Mining Co.'s 1st Nat. Bank (Ft. Stockton) 1, 490 ft s of Pecos River and 330 ft e of n-s center line of H&GN 6, Blk 9, completed April 6, 1939, as discovery of north sector that advanced into Ward County. **Type of Structure:** Anticline. **Producing Formations:** Yates (Byrne sector) 1120-1380 ft, averaging 30 ft. of penetration. Yates (north sector) 1730-1912 ft, averaging 49 ft of penetration. **Production Area:** 1600 acres (scattered). **Production June 30, 1947:** Daily: 593 bbls. Cumulative: 2,364,600 bbls. Estimated remaining reserves: 2,435,000 bbls. **Producing Wells June 30, 1947:** Total: 124 (flowing: 54; artificial lift: 70). Dormant: 15. **Gravity:** 36-39. **Rigs Running June 30, 1947:** 3. **Deepest Test:** Peerless O&G Co's White 4, s cor of lse in H&TC 36, Blk 1, Ward County, failure at 4365 ft. **Oil Outlets:** Comanche, Noelke. **Principal Leaseholders:** George Abell, Burk Roy., Jamison & Pollard, Kone Prod., C. S. Messinger, P. L. Crandall, Sunray, Union Oil & Mining of development pending in west portion of Co., H. I. Waid. **Remarks:** Nominal volume field and north end of the Byrne sector.

PECOS

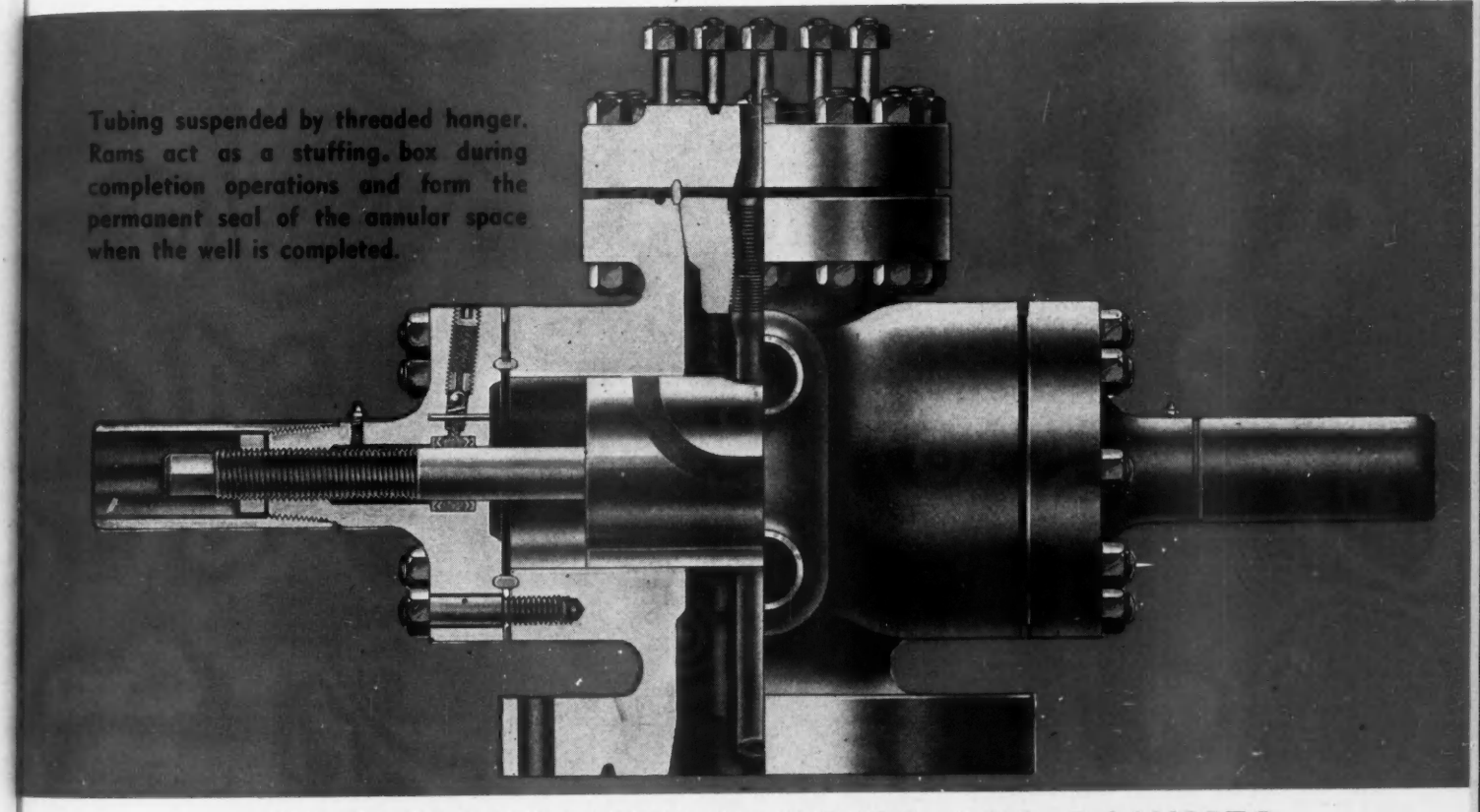
ABELL ORDOVICIAN

Discovery Data: Production indicated by earlier deep failure. **Discovery Well:** Stanolind's (was Ed Taubert-Jessie McKee-C. J. Siemoneit) V. W. Crockett 1, 660 fr wswl 325.4-ac. tract, H&TC Sect. 4½, Blk 3, October 30, 1940, McKee sand discovery. Magnolia's Sharp-State 1, Lot 9, H&GN 22, Blk 9, March 27, 1941, Waddell-Sharp sand discovery. Siemoneit Drlg. Co.'s Walsh 1 Lot 11, H&GN 25, Blk 9, December 29, 1941, Clear Fork discovery. Magnolia's J. F. McKee 1, Lot 13, H&GN Sect. 25, Blk 9, July 29, 1941, (Ellenburger discovery) Magnolia's Crockett 3, Lot 9, H&TC Sect. 4½, Blk 3, July 16, 1941, Simpson Basal dolomite discovery. **Type of Structure:** Anticline. **Producing Formations:** Simpson (McKee sandstone) 4985-5500 ft, average 17 ft penetration. Simpson (Waddell-Sharp sand) 5441-5971 ft, average 11 ft penetration. Simpson dolomite 5711-34 ft. Ellenburger dolomite 5820-5934 ft, average 62 ft penetration. **Producing Area:** 3100 acres.

RECTORHEAD

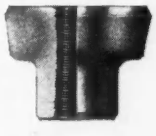
ROUND RAM

TUBING HEAD



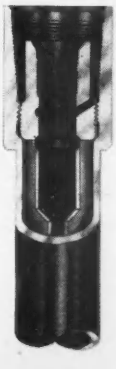
Tubing suspended by threaded hanger. Rams act as a stuffing box during completion operations and form the permanent seal of the annular space when the well is completed.

INTERCHANGEABLE HANGERS AND BONNETS



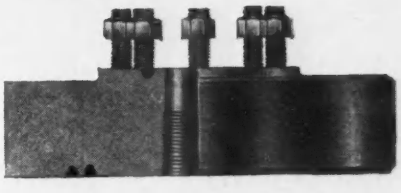
Threaded Hanger

This Type "A" hanger is threaded for the size tubing to be used. It rides flush with the top of the tubing head. API ring gasket acts dually as seal and hold down.



Recessed Coupling

This coupling is used for suspending and sealing the tubing by means of the rams. The coupling, made of heat-treated alloy steel, is available with or without back pressure valve. The suspension shoulder is the same O.D. as tubing couplings; recessed portion is same O.D. as the tubing. The standard tubing coupling just below the hanger nipple acts as a hold down if there is a tendency for the tubing to be blown from the hole.



Studded Bonnet

These bonnets are available plain or threaded, permitting their use with any of the three methods of tubing suspension. They are made of highest grade alloy steel, and furnished complete with studs, nuts and API ring gasket.

Production June 30, 1947: Daily: 1460 bbls. (all zones). Cumulative: 4,759,205 bbls. (all zones). Estimated remaining reserves: 4,866,000 bbls. (all zones). **Producing Wells June 30, 1947:** Total: 77 (flowing: 72; artificial lift: 5). **Gravity:** 40-44. **Rigs Running June 30, 1947:** None. **Deepest Test:** Magnolia's A. M. Loar State 1, 330 ft out of n cor Sect. 2, Blk 3, H&TC failure in Ellenburger 6282-6483 ft. **Oil Outlets:** Texas-New Mexico, Magnolia. **Principal Leaseholders:** Geo. T. Abell, Magnolia, Sinclair Prairie, Skelly, Stanolind, Talvez Oil Co. **Remarks:** Increasing number of Ordovician wells incapable of making allotted production. Those depleted will be plugged back to Permian oil zones. Permian zones discussed under separate heading.

ABELL PERMIAN

Discovery Data: Geology. **Discovery Well:** Siemoneit Drlg. Co., et al's Walsh & Meyers 1, 330 ft out of SWc Lot 11, H&GN Ry 25, Blk 9, completed December 29, 1941, discovery of 3900 foot Wichita-Albany zone. Stanolind-Magnolia's Fogelman-Gerety Unit 1, 673 ft ewl and 649 ft nsl Lot 4, H&GN Ry 23, Blk 9, completed August 4, 1942, discovery of 3200-ft Basal San Andres zones. Magnolia's Grove-State 2, 648 ft snl and 674 ft ewl Lot 6, H&GN Ry 26, Blk 9, completed April 4, 1947, Middle San Andres discovery. **Type of Structure:** Anticline. **Producing Formations:** Wichita-Albany 3840-3950 ft; 5 wells, averaging 29 ft of lime pay. Basal San Andres 3230-46 ft; 2 wells, averaging 16 feet of lime pay. Middle San Andres 3165-75 ft; 1 well. **Production June 30, 1947:** Daily: 281 bbls (includes Conry-Davis sector). Cumulative: 614,452 bbls (includes Conry-Davis sector). Estimated remaining reserves: 320,000 bbls. **Producing Wells June 30, 1947:** Total: 19 (flowing: 6; artificial lift: 13; includes Conry-Davis). **Gravity:** Wichita-Albany 35.3-36.8; Basal San Andres 34; Middle San Andres 34. **Rigs Running June 30, 1947:** None. **Deepest Test:** Discussed under Abell Ordovician. **Oil Outlets:** Texas-New Mexico, Magnolia. **Principal Leaseholders:** Magnolia, Stanolind, Tide Water. **Remarks:** Majority of wells have declined to marginal status. New wells will be added through the plugging back to Ordovician wells when depleted in the deeper zones.

APCO-WARNER

Discovery Data: Geology-geophysics. **Discovery Well:** Anderson-Prichard-Monte Warner's J. S. Masterson 1, C S¼ N¼ H&GN 104, Blk 10, April 30, 1939. **Type of Structure:** Anticline. **Producing Formations:** Ellenburger dolomite 4396-4793 ft, average 71 ft penetration. **Producing area:** 1880 acres. **Production June 30, 1947:** Daily: 1910 bbls. Cumulative: 3,035,841 bbls. Estimated remaining reserves: 13,884,000 bbls. **Producing Wells June 30, 1947:** 47 (flowing: 40; artificial lift: 7). **Gravity:** 36-42.6. **Rigs Running June 30, 1947:** None. **Deepest Test:** Humble's Shearer 2, C S¼ S¼ H&GN 99, Blk 10, failure in Ellenburger at 5356 ft. **Oil Outlets:** Texas-New Mexico, Magnolia. **Principal Leaseholders:** Anderson-Prichard, Bay Pet., Humble, Magnolia, Skelly, Standard, Sunray. **Remarks:** Fully developed and defined by failures.

CHANCELLOR

Discovery Data: Geology, core drilling. **Discovery Well:** Pure's T. P. Land Tr 1-A, C SW SW T&P Ry 31, Blk 49, Tsp 10, completed March 25, 1942. **Type of Structure:** Anticline. **Producing Formations:** Delaware 5055-5274 ft, averaging 110 ft of broken sandy-lime pay. **Producing Area:** 80 acres. **Production June 30, 1947:** Daily: 31 bbls. Cumulative: 98,551 bbls. Estimated remaining reserves: 90,000 bbls. **Producing Wells June 30, 1947:** 2 pumping. **Gravity:** 37.5-38.5. **Rigs Running June 30, 1947:** None. **Deepest Test:** Discovery plugged back from 6001 ft. **Oil Outlets:** Truck. **Principal Leaseholders:** Pure. **Remarks:** Delaware failures offset production NW, NE and S. Further development improbable, unless to southwest as offset to largest well, which drilled only 1 foot in pay.

CHOATE-BROWN

Discovery Data: Geology. **Discovery Well:** L. H. Choate-C. W. Brown's University 1-15, C NW NW Sect. 15, Blk 20, completed October 6, 1943. **Type of Structure:** Anticline. **Producing Formations:** Yates sand 1355-68 ft. **Producing Area:** 40 acres. **Production June 30, 1947:** Daily: Included with Taylor-Link field. **Producing Wells June 30, 1947:** 1 pumping. **Gravity:** 36. **Rigs Running June 30, 1947:** None. **Deepest Test:** Choate & Brown's University-Humble 1, C SW NE Sect. 14, Blk 20, failure at 1507 ft. **Oil Outlets:** Trucks. **Remarks:** Discovery is 3¾ miles northwest of Taylor-Link field, nearest production; dry holes preclude further development in shallow zones.

CONRY-DAVIS

Discovery Data: Geophysics. **Discovery Well:** Stanolind's Conry-Davis 1, C Lot 8, H&GN Ry Blk 9, completed July 2, 1941, as discovery for Clear Fork (Tubb) zone. Magnolia-Geo. T. Abell's Myrick-State 1-B, 673 ft E and 69 ft S of SWc H&GN Ry 31, Blk. 9, but in Myrick Vacancy, completed December 1, 1941, discovery for Upper San Andres zone. **Type of Structure:** Anticline. **Producing Formations:** Clear Fork (Tubb) 3747-3960 ft; 5 wells, averaging 36 ft of broken lime pay. Upper San Andres 2250-2350 ft; 9 wells, averaging 27 ft of broken lime pay. **Producing Area:** Clear Fork 200 acres; Upper San Andres 360 acres. **Production June 30, 1947:** Daily: Included with Abell-Permian field. Estimated remaining reserves: Included with Abell-Permian field. **Producing Wells June 30, 1947:** Clear Fork: 4 pumping. Upper San Andres: 8 wells (flowing: 4; artificial lift: 4). **Gravity:** Clear Fork 30.9-36.8; San Andres 34-37. **Rigs Running June 30, 1947:** None. **Deepest Test:** Stanolind's Conry-Davis Unit 1, field discovery, plugged back from granite 5740-45 ft; entered barren Ellenburger at 4825 ft. **Oil Outlets:** Texas-New Mexico. **Principal Leaseholders:** Geo. T. Abell, Magnolia, Skelly, Stanolind, Talvez, Texas Co. **Remarks:** Officially prorated as Abell Permian field, although more than 3 miles apart. Conry-Davis sector can be expanded.

COURTNEY-PRYOR

Discovery Data: Geology. **Discovery Well:** Chesney & Jones' (was Phillips) Courtney-Pryor 1, 440 ft out of NWc Sect. 78, TMR Sur, Blk OW, completed May 22, 1929. **Type of Structure:** Unidentified. **Producing Formations:** Permian 1340-75 ft. **Producing Area:** 60 acres. **Production June 30, 1947:** Daily: 9 bbls. Cumulative: 34,920 bbls. Estimated remaining reserves: Negligible. **Producing Wells June 30, 1947:** 2 pumping. **Gravity:** 25-26. **Rigs Running June 30, 1947:** None. **Deepest Test:** Discovery plugged back from 4376 ft. **Oil Outlets:** Trucks. **Principal Leaseholders:** Chesney & Jones. **Remarks:** Properties changed hands frequently due to isolation from market and small yield; wells operated infrequently.

DAVIS

Discovery Data: Geology. **Discovery Well:** H. L. Cain & Sam G. Dunn's Downs-Sun 1, 1787 ft nsl 853 ft wel H&GN Ry 105, Blk 8, completed September 5, 1941, gas-pay discovery from Yates, plugged January, 1944. R. G. Patillo, T. Davis-Sun 1, 1050 ft wel 2400 ft nsl H&GN Ry 105, Blk 8, completed August 19, 1945, oil-pay discovery. **Type of Structure:** Anticline. **Producing Formations:** Yates 1559-70 ft, averaging 6 ft of sand. **Producing Area:** 80 acres. **Production June 30, 1947:** Daily: 44 bbls. Cumulative: 6951 bbls Aug. 1, 1947. Estimated remaining reserves: 70,000 bbls. **Producing Wells June 30, 1947:** 2 flowing. **Gravity:** 21-22. **Rigs Running June 30, 1947:** None. **Deepest Test:** Plymouth Oil's Levy 1, SWc H&GN Ry 104, Blk 8, failure in Devonian at 6095-6473 ft. **Oil Outlets:** Trucks. **Principal Leaseholders:** Discoverer. **Remarks:** Officially prorated as Pecos Valley high gravity field. Both oil wells making unusually large volume of water.

FORT STOCKTON

Discovery Data: Geophysics. **Discovery Wells:** Humble's O. W. Williams 1, C NW NE GC&SF Ry 3 Blk 114, completed August 22, 1944. **Type of Structure:** Anticline. **Producing Formations:** Yates (oil) 2760-2910 ft; 42 wells, averaging 54 ft broken sand. Yates (gas) 2710-2910 ft; 3 wells, averaging 128 ft broken sand. **Producing Area:** Developed (oil): 1680 acres. Developed (gas) 120 acres. **Production June 30, 1947:** Daily: 1431 bbls. (base allowable). Cumulative: 562,283 bbls. Estimated remaining reserves: 6,158,000 bbls (developed). **Producing Wells June 30, 1947:** Total: 42 (flowing: 33; artificial lift: 9). **Gravity:** 29.6-37.8. **Rigs Running June 30, 1947:** 2. **Deepest Test:** Humble's Williams 2, SE SW NE GC&SF 3, Blk 114, plugged back from Delaware at 4903 ft. **Oil Outlets:** Texas-New Mexico. **Principal Leaseholders:** K. D. Harrison, Humble, Magnolia, Mid-Continent, Phillips, Texas Co. **Remarks:** Considerable inside drilling possible, but bulk of such acreage will have low average crude yield per acre.

FROMME

Discovery Data: Geology. **Discovery Well:** Sunray's (was Superior) Crockett-Skelly 1, 330 ft SE 330 ft SW of W cor H&GN 106, Blk 10, but in TC Ry 5, Blk 110, completed June 30, 1939, discovery of upper pay. Atlantic's (was Cordova Union Corp.) Fee 2-F, 1470 ft SE and 330 ft SE of W cor H&GN 106, Blk 10 but in Pink Phelps Sur, completed September 12, 1939, as lower-pay discovery. **Type of Structure:** Anticline. **Producing Formations:** Queen 1400-1502 ft, averaging 21 ft of pay. Grayburg 1632-78 ft, averaging 7 ft of lime pay. **Producing Area:** 300 surface acres. **Production June 30, 1947:** Daily: 50 bbls. Cumulative: 150,615 bbls. Estimated remaining reserves: Not important. **Producing Wells June 30, 1947:** Total: 10 (flowing: 4; artificial lift: 6). **Gravity:** 27-31. **Rigs Running June 30, 1947:** None. **Deepest Test:** Discussed under Apco-Warner field. **Oil Outlets:** Comanche P. L. Corp. **Principal Leaseholders:** Atlantic, W. H. Burleson, Burk Roy. Co., Sunray. **Remarks:** Involves small 2-pay area adjacent to deep and shallow areas. Development terminated by failures.

GRASSROOTS

Discovery Data: Geology. **Discovery Well:** R. C. Webster-J. H. Finney's (was O. E. Schkade) Lehman-Cities Service 1, 990 ft ewl and 2450 ft nsl H&GN 107, Blk 8, completed March 20, 1940. **Type of Structure:** Anticline. **Producing Formations:** Permian 43-70 ft, averaging 11 ft of sand. **Producing Area:** 40 acres. **Production June 30, 1947:** Depleted. Cumulative: 515 bbls. Estimated remaining reserves: None. **Gravity:** 12. **Oil Outlets:** Trucks. **Remarks:** Wells initially pumped from ½ to 1 bbl daily; oil used on highways.

HEINER

Discovery Data: Subsurface, geophysics. **Discovery Well:** Culbertson & Irwin's Heiner 1, C NE NE GC&SF Ry 589, completed March 25, 1941. **Type of Structure:** Anticline. **Producing Formations:** Ellenburger 5382-5509 ft, averaging 116 ft of broken dolomite pay. **Producing Area:** 80 acres. **Production June 30, 1947:** Daily: 30 bbls. Cumulative: 43,819 bbls. Estimated remaining reserves: 56,181 bbls. **Producing Wells June 30, 1947:** 2 flowing. **Gravity:** 35. **Rigs Running June 30, 1947:** None. **Deepest Test:** Union Oil's Heiner 1-C, C NW SE GC&SF Ry 589, failure in granite at 6161½ ft, logging 903 ft of barren Ellenburger. **Oil Outlets:** Texas-New Mexico. **Principal Leaseholders:** Discoverers. **Remarks:** Small crude yield and failures discourage further development, unless to northeast.

JACKSON

(GAS)

Discovery Well: Byrd & Frost's J. S. Jackson-Sun 1, NE NE SW H&GN 46, Blk 11, completed January 18, 1946. **Type of Structure:** Anticline. **Producing Formations:** Yates sd at 1220-1308 ft, broken pay. **Producing Area:** 40 acres. **Producing Wells June 30, 1947:** Total: 1 (gas). **Rigs Running June 30, 1947:** None. **Deepest Test:** Gulf-Wentz's Millar 1, 467 ft out SWc H&GN 39, Blk 11, failure in granite at 4532-38 ft. **Gas Outlets:** None. **Remarks:** Gas reserves inadequate to warrant continued development.

JAMISON AND POLLARD

Discovery Data: Geology. **Discovery Well:** T. E. Jamison-Chas. Pollard's Pecos Valley Oil Co. 6-D-E, 150 ft fr nel 1049 ft fr sel of E¼ S¼ H&TC Ry 36, Blk 3, completed February 23, 1941. **Type of Structure:** Anticline. **Producing Formations:** San Andres 1975-2050 ft, averaging 23 ft of lime pay. **Producing Area:** Developed: 160 acres. **Production June 30, 1947:** Daily: 25 bbls. Cumulative: 145,578 bbls. Estimated remaining reserves: Not important. **Producing Wells June 30, 1947:** 4 artificial lift. **Gravity:** 24.9. **Rigs Running June 30, 1947:** None. **Deepest Test:** Humble's Young 1, C N¼ of W¼ H&GN 33, Blk 10, failure in Simpson at 5624-7430 ft. **Oil Outlets:** Comanche. **Principal Leaseholders:** L. W. Fritz et al, Jamison & Pollard. **Remarks:** Production accompanied by large volume of sulphur water; 3 wells inactive July 1, 1947. Area is within the Pecos Valley low gravity sector.

LEHN-APCO "1600"

Discovery Data: Geology, trend. **Discovery Well:** Burk Royalty Co.'s (was H. L. Cain-W. E. Keeney) Lehn-Texaco 1, 330 ft out of e cor H&GN 71, Blk 10, completed June 21, 1939. **Type of Structure:** Anticline. **Producing Formations:** Seven Rivers 1600-1783 ft, averaging 38 ft of broken pay (field proper). **Producing Area:** 1320 acres (total of 4 separate sectors). **Production June 30, 1947:** Daily: 285 bbls (4 areas). Cumulative: 792,566 bbls (4 areas). Estimated remaining reserves: 4,487,000 bbls (4 areas). **Producing Wells June 30, 1947:** Total four areas: 80 (flowing: 24; artificial lift: 56). **Gravity:** 29-34. **Rigs Running June 30, 1947:** 2. **Deepest Test:** Skelly's Colden 1, C E¼ E¼ H&GN 80, Blk 10, failure in Ellenburger 6265-6365 ft. **Oil Outlets:** Noelke P. L., Texas-New Mexico. **Principal Leaseholders:** Burk Roy. Co., Childress Roy. Co., Krupp Flaherty Oil Corp., W. Y. Penn, R. B. Rawlins et al, Skelly. **Remarks:** Field comprises 4 separate areas for purpose of proration; these include Lehn-Apco "1600," Patillo-O'Neil, Patillo-Iowa and Penn-Shearer. Producing area, wells, cumulative and reserves of all area consolidated under Lehn-Apco "1600". Patillo-O'Neil and Penn-Shearer will be expanded.

MAC DER

Discovery Data: Geophysics. **Discovery Well:** Standard of Texas' Mac Der Co. 1, C NE NW T&St.LRR Sur 36, Blk 144, completed March 20, 1944, gas field discovery. Humble's Wilson 1, 763 ft nsl 1925 ft ewl T&St.LRy 1, Blk 45, completed March 22, 1945, converted from gas to oil. **Type of Structure:** Anticline. **Producing Formations:** Wolfcamp (gas) 4706-5010 ft; 4 wells, averaging 15 ft of lime pay. Wolfcamp (oil) 4706-5010 ft; 3 wells (con-

verted gassers). **Producing Area:** Oil: 80 acres. Gas: 160 acres. **Production June 30, 1947:** Daily: 3 bbls. Cumulative: 1451 bbls. Estimated remaining reserves: Negligible. **Producing Wells June 30, 1947:** 1 flowing; 3 gas. **Gravity:** 32-37. **Rigs Running June 30, 1947:** None. **Deepest Test:** Standard of Texas' Mac Der 1, Lse 3, C SW SW H&GN 64, Blk 11, plugged back from granite 5373-5374½ ft. **Oil Outlets:** Trucks. **Gas Outlet:** Helmerich & Payne to Girvin, Texas. **Principal Leaseholders:** Standard of Texas. **Remarks:** Field discovery established first commercial production for state from Wolfcamp (Permian); 2 gassers later reclassified as small oil wells. Wolfcamp zone has subnormal yield of oil or gas.

MASTERSON

Discovery Data: Surface geology. **Discovery Well:** General Crude s (was Cranfill-Reynolds Co., M. Warner et al) J. Masterson 1-A, 330 ft out of s cor H&GN 104, Blk 10, December 16, 1929. **Type of Structure:** Anticline. **Producing Formations:** Queen sand 1403-1501 ft, averaging 28 ft of pay. **Producing Area:** 400 acres. **Production June 30, 1947:** Daily: 81 bbls. Cumulative: 1,159,662 bbls. Estimated remaining reserves: 100,000 bbls. **Producing Wells June 30, 1947:** 24 pumping. **Gravity:** 35-36. **Rigs Running June 30, 1947:** None. **Deepest Test:** Discussed under Apco-Warner field. **Oil Outlets:** Noelke P. L. Co., trucking. **Principal Leaseholders:** Burk Roy. Co. sole operator. **Remarks:** Consists of 1 cluster of small adjoining pools; now stripper well basis.

MASTERSON "3500"

Discovery Data: Geology. **Discovery Well:** Magnolia-Anderson-Prichard's E. C. Powell-State 1, C W¼ S¼ H&GN 96, Blk 10, completed July 8, 1943. **Type of Structure:** Anticline. **Producing Formations:** Clear Fork 3539-46 ft, involving 7 ft of lime pay. **Productive Acres:** 40 acres. **Production June 30, 1947:** Daily: 8 bbls. Cumulative: 60,982 bbls. Estimated remaining reserves: Negligible. **Producing Wells June 30, 1947:** 1. **Gravity:** 21.9. **Rigs Running June 30, 1947:** None. **Deepest Test:** Owners' State-Powell 2, C N¼ S¼ H&GN 96, Blk 10, failure in granite 4685-4700 ft. **Oil Outlets:** Magnolia. **Principal Leaseholders:** Discoverers. **Remarks:** Production probably from crevice; accompanied by large volume of water. Further development improbable.

NETTERVILLE

Discovery Data: Surface geology. **Discovery Well:** Superior's (was Tex-Mex Pet. Corp.) G. W. Walling 1, 5610 ft n and 330 e of SWc H&GN 59, Blk 8, September 28, 1934. **Type of Structure:** Anticline. **Producing Formations:** Yates 2085-2360 ft, averaging 105 ft of sandy-lime pay. **Producing Area:** Developed: 240 acres. **Production June 30, 1947:** Daily: 45 bbls. Cumulative: 478,515 bbls. Estimated remaining reserves: 80,000 bbls. **Producing Wells June 30, 1947:** Total: 16 (flowing: 11; artificial lift: 5). **Gravity:** 33-35. **Rigs Running June 30, 1947:** None. **Deepest Test:** Superior's Potts 1, NEc N½ S½ E½ H&GN 41, Blk 8, failure in San Andres at 2566 ft. **Oil Outlets:** Wickett P. L. Co. **Principal Leaseholders:** R. B. Rawlings, Sunray, Worth Drlg. Co. **Remarks:** Production developed at intervals along 3-mile trend; long flowing life attributed to wells being scattered. No further development indicated.

OATES

Discovery Data: Geology. **Discovery Well:** Pure's J. S. Oates 1-B, 1841 ft nsl and 963 ft wel T&P Ry 204, Blk 3, completed April 10, 1947. **Type of Structure:** Anticline. **Producing Formations:** Rustler 840-45 ft, involving 5 ft of lime pay. **Producing Area:** 40 acres. **Production June 30, 1947:** Daily: 39 bbls. Cumulative: 1542 bbls. Estimated remaining reserves: 8458 bbls. **Producing Wells June 30, 1947:** 1 pumping. **Gravity:** 18.2. **Rigs Running June 30, 1947:** 1. **Deepest Test:** Pure's Harrison 1, SW SW NW T&P 203, Blk 3, failure in Pennsylvanian (Cisco) at 10,230-11,815 ft. **Oil Outlets:** Trucks. **Principal Leaseholders:** Pure. **Remarks:** Drilled as auxiliary water well for deep test; production from pocket or crevice and zone not productive normally.

OWEGO

Discovery Data: Geology-geophysics. **Discovery Wells:** Bryce McCandless et al's Cordova Union-Gulf 1-101, C SE SW H&GN 101, Blk 11, completed November 21, 1943, field discovery, Ellenburger oil producer, depleted oil, recompleted August 23, 1945, as gasser. Bryce McCandless et al's Cordova Union-Gulf 1-115, SE NE SE H&GN 115, Blk 11, completed July 18, 1946, new gas pay discovery. Bryce McCandless et al's Cordova Union-Gulf 2-101, NW NW SW H&GN 101, Blk 11, completed April 26, 1947, new gas pay discovery. **Type of Structure:** Anticline. **Producing Formations:** Ellenburger 4012-37 ft; 1 well, involving 25 ft dolomite pay. Clear Fork (gas) 2250-60 ft; 1 well. Clear Fork (gas) 2970-90 ft; 1 well. Clear Fork (gas) 2440-66 ft; 1 well. **Production June 30, 1947:** None. **Producing Wells June 30, 1947:** 3 gas. **Gravity:** 35.4. **Rigs Running June 30, 1947:** None. **Deepest Test:** Magnolia's Lemar 1-A, C NE NW H&GN 100, Blk 10, failure in Ellenburger at 4258-4572 ft. **Gas Outlets:** McCandless et al to Helmerich & Payne carrier to Girvin. **Principal Leaseholders:** McCandless et al. **Remarks:** Ellenburger oil discovery flowed 247 barrels initial via ¼-in. choke, but water broke in and workover attempts failed. PB to gas at 2970-90 ft.

PATILLO-IOWA

Discovery Data: Geology. **Discovery Well:** Burk Roy. Co. (was Debs Pattillo) Iowa Realty Trust 1, C E¼ N¼ W¼ H&GN Ry 61, Blk 10, completed May 1, 1944. **Type of Structure:** Anticline. **Producing Formations:** Seven Rivers 1262-1356 ft, averaging 37 ft broken lime pay. **Producing Area:** 60 acres. **Production June 30, 1947:** Daily: 18 bbls. Cumulative: Included with Lehn-Apco "1600". Estimated remaining reserves: Unimportant. **Producing Wells June 30, 1947:** 3 pumping. **Gravity:** 27-30. **Rigs Running June 30, 1947:** None. **Deepest Test:** None. **Oil Outlets:** Trucks. **Principal Leaseholders:** Burk Roy. Co. **Remarks:** Situated 2½ miles south of Lehn-Apco "1600" field, and prorated under latter for convenience. More development will occur.

PATILLO-O'NEIL

Discovery Data: Geology. **Discovery Well:** Burk Roy. Co. (was R. G. Patillo) O'Neil 1, C S¼ S¼ H&GN 74, Blk 10, completed December 5, 1940. **Type of Structure:** Anticline. **Producing Formations:** Queen 1600-98 ft, averaging 29 ft of sand pay. **Producing Area:** 400 acres. **Production June 30, 1947:** Included under Lehn-Apco "1600." **Producing Wells June 30, 1947:** Total: 25 (included with Lehn-Apco "1600"). **Gravity:** 34-35. **Rigs Running June 30, 1947:** None. **Deepest Test:** Anderson-Prichard-Magnolia's Powell 1, C W¼ W¼ H&GN 98, Blk 10, failure in Ellenburger 5055-5318 ft. **Oil Outlets:** Noelke. **Principal Leaseholders:** Burk Roy., Childress Roy. Co., R. B. Rawlins, Skelly. **Remarks:** Situated 1½ miles southeast of Lehn-Apco "1600" field, but incorporated with latter for proration purpose. Nominal volume of development pending.

PECOS VALLEY LOW GRAVITY

Discovery Data: Surface geology. **Discovery Well:** Pecos Crude Oil Purchasing Co.'s (was Pecos Valley Oil Co.) Pecos Valley Oil Co. 1, C W¼ H&GN 22, Blk 10, November 20, 1928. **Type of Structure:** Anticline. **Producing Formations:** Yates 1500-1690 ft, averaging 62 ft of penetration. **Producing Area:** 2400 acres (scattered). **Production June 30, 1947:** Daily: 593 bbls. Cumulative: 1,353,700 bbls. Estimated remaining reserves: 3,446,000 bbls. **Producing Wells June 30, 1947:** Total 130 (flowing: 54; pumping: 76). **Gravity:** 25-29. **Rigs Running June 30, 1947:** 3. **Deepest Test:** Humble's Young 1, C N¼ W¼ H&GN 33, Blk 10, failure in Simpson at 5624-7430 ft. **Oil Outlets:** Comanche, Noelke, Reichman P. L. **Principal Leaseholders:** Bennett & Opal Black Hale, M. H. Black, Culbertson & Irwin, Harris G. Eastman, A. C. Fritz, Pecos Valley Oil, L. W. Fritz, Jamison & Pollard, Geo. Kidd, Kone Prod. Co., Thos. C. Liddell, Mid-Continent, J. F. Pickle, Reichman, Ritter Walker Inderrieden Synd, Sinclair, Stanfield & Walker, Street and Knight, Sunray. **Remarks:** Moderate development underway in sectors capable of flowing production. Deep rights in demand in anticination of pre-Permian production within the area.

PENN-SHEARER

Discovery Data: Geology. **Discovery Well:** Wm. Y. Penn et al's Shearer-Humble 1, 330 ft out of w cor of N¼ H&GN 41, Blk 10, completed March 28, 1946. **Type of Structure:** Anticline. **Producing Formations:** Yates 1920-72 ft, averaging 33 ft of pay. **Producing Area:** 80 acres. **Production June 30, 1947:** Daily: 240 bbls. (base allowable). Cumulative: Included with Lehn-Apco "1600". **Producing Wells June 30, 1947:** 8 flowing. **Gravity:** 35.5-36. **Rigs Running June 30, 1947:** 2. **Deepest Test:** Magnolia's Eaton-Abell 2, e cor H&TC 23, Blk 3, 1¼ mi w of field, failure in Ellenburger at 5120-71 ft. **Oil Outlets:** Trucks. **Principal Leaseholders:** Wm. Y. Penn et al, Peck & Croft. **Remarks:** Situated 3½ miles north of Lehn-Apco "1600" field, and incorporated with same for proration purpose, although separate structures. Eight consecutive flowing completions on 10-acre spacing emphasize the possibilities of the area.

ROWAN-TONG

Discovery Data: Random drilling. **Discovery Well:** Independent O&G Co., Rowan-Tong's J. A. McDonald 1, 1170 ft snl and 2490 ft wel H&GN 46, Blk 12, completed August 27, 1929. **Type of Structure:** Anticline. **Producing Formations:** Permian lime 1605-12 ft. **Producing Area:** 40 acres. **Production June 30, 1947:** Cumulative: 2000 bbls. Estimated remaining reserves: Depleted. **Gravity:** 28-29. **Rigs Running June 30, 1947:** None. **Deepest Test:** Discovery deepened without results to 1644 ft. **Remarks:** Discovery flowed briefly but is exhausted.

SHEARER

Discovery Data: Geology. **Discovery Wells:** Pecos Onondago Corp. s Fromme-California Co. 1, 2310 ft from sel 330 ft from swl H&GN 110, Blk 10, completed March 26, 1937, discovery in upper pay. Geo. Davis & M. L. White's Fromme 1, 330 ft out of w cor N¼ H&GN 110, Blk 10, completed November 29, 1940, discovery of lower pay. **Type of Structure:** Anticline. **Producing Formations:** Seven Rivers 1388-1558 ft, averaging 40 ft of pay. Lower pay 1865-88 ft. **Producing Area:** 320 acres. **Production June 30, 1947:** Daily: 163 bbls. Cumulative: 1,661,912 bbls. Estimated remaining reserves: 120,000 bbls. **Producing Wells June 30, 1947:** 43 pumping. **Gravity** 34-36. **Rigs Running June 30, 1947:** None. **Deepest Test:** Discussed under Apco-Warner field. **Oil Outlets:** Comanche P. L. Corp. **Principal Leaseholders:** Burk Roy. Co., Childress Roy. Co. **Remarks:** Field has declined to stripper well basis; defined by failures.

TAYLOR-LINK

Discovery Data: Geology. **Discovery Well:** Lee Pet. Corp.'s (was Taylor-Link Oil Co.) University 1, 533 ft n and 1040 ft e of SWc Sect 30, Blk 16, June 15, 1929. **Type of Structure:** Anticline. **Producing Formations:** Yates sand 950-1000 ft, average 25 ft penetration; San Andres lime 1350-1400 ft, average 30 ft penetration; San Andres lime 1580-1780 ft, average 50 ft penetration. **Producing Area:** Developed: 2800 surface acres. **Production June 30, 1947:** Daily: 1039 bbls. Cumulative: 9,908,-553 bbls. Estimated remaining reserves: 3,302,-000 bbls. **Producing Wells June 30, 1947:** Total 158 (flowing 17; artificial lift: 141). **Gravity:** 29-30. **Rigs Running June 30, 1947:** 1. **Deepest Test:** None within field below San Andres; Humble's University 1-K, C NE NE SEc 18, Blk 16, failure in Ellenburger at 7650-7730 ft. **Oil Outlets:** Shell. **Principal Leaseholders:** Amerada, Arkansas Fuel, Beakley & Whiteside, D. Breeding, Continental, H. G. Eastham, Jr., Helmerich & Payne, Shallow Sand Oil Co., Shell, Standard of Texas, Stanolind, Walsh Inv. Co., William Wolf, Claude Brown & R. U. Fitting, Jr., Burk Roy., Byrd & Frost, Geo. L. Guthrie, E. E. Langford, J. D. Lancaster, Sam Letwin et al, A. W. Rutter, Remlig Oil Co. **Remarks:** Nominal volume of drilling due on edge of field. Some inside locations not drilled due to small offset producers. Ellenburger test scheduled for field proper.

TAYLOR-LINK SOUTHEAST (GAS)

Discovery Data: Random drilling. **Discovery Well:** Geo. H. Anderson-Tower & McKanna's, University 1, 1210 ft wel and 1125 ft snl SEc 11, Blk 17, February 2, 1929. **Type of Structure:** Anticline. **Producing Formations:** Yates 1593-1963 ft, averaging 5 ft of pay. **Producing Area:** 200 acres (scattered). **Producing Wells June 30, 1947:** 5 gas. **Rigs Running June 30, 1947:** None. **Deepest Test:** Discovery plugged back from 1998 ft. **Gas Outlets:** Helmerich & Payne. **Principal Leaseholders:** Helmerich & Payne. **Remarks:** Substantial area proved for gas, but volume is small.

WALKER

Discovery Data: Geology and trend. **Discovery Well:** Gulf's White-Baker 3, SE SE NE TC Ry 4, Blk 207, completed December 31, 1934, depleted September 1936. Childress Roy. Co.'s (was R. L. Walker et al) White-Baker 1, NW NW SE GC&SF 86, Blk 194, completed April 7, 1940, designated as Walker field. **Type of Structure:** Anticline. **Producing Formations:** Queen and Grayburg 1735-2175 ft, averaging 19 ft of pay penetration. **Producing Area:** Developed: 1660 acres. **Production June 30, 1947:** Daily: 934 bbls. Cumulative: 2,064 655 bbls. Estimated remaining reserves: 5,405,000 bbls. **Producing Wells June 30, 1947:** Total: 83 (flowing 54; artificial lift: 29). **Gravity:** 31-34. **Rigs Running June 30, 1947:** 2. **Deepest Test:** Gulf's White-Baker 1, SE NE GC&SF 85, Blk 194, failure at 4280 ft. **Oil Outlets:** Shell. **Principal Leaseholders:** W. H. Burleson, B. C. F. Oil Co., Childress, Cities Service, Helmerich & Payne, Jas. L. Cooner, Lewis & Engle, McElroy Ranch Co., Stanolind, William Wolf. **Remarks:** Few leases on west edge of structure assigned to Taylor-Link field for proration purposes. More development pending within and on edge of field.

WENTZ

Discovery Data: Geology-geophysics. **Discovery Well:** Gulf-L. H. Wentz's L. H. Millar 2, C NW SE H&GN Ry. 43, Blk 11. December 27, 1941. **Type of Structure:** Anticline. **Producing Formations:** Ellenburger 4307-92 ft, averaging 27 ft of dolomite, with 1 well possibly deriving some production from underlying Cambrian sandstone. **Producing Area:** 80 acres. **Production June 30, 1947:** Daily: 67 bbls. Cumulative: 111,566 bbls. Estimated remaining reserves: 140,000 bbls. **Producing Wells June 30, 1947:** 2 pumping. **Gravity:** 33-

38.8. **Rigs Running June 30, 1947:** None. **Deepest Test:** Gulf-Wentz's O Sullivan 1, SW NW H&GN 39, Blk 11, failure in granite at 4630-34 ft. **Oil Outlets:** Trucks. **Principal Leaseholders:** Discoverers. **Remarks:** Small crude yield and nearby failures discourage further development.

WENTZ SOUTH
(GAS)

Discovery Data: Geology. **Discovery Well:** Byrd & Frost's Jackson-Sun 1, NE NE SW H&GN 46, Blk 11, completed January 18, 1946. **Type of Structure:** Anticline. **Producing Formations:** Yates 1220-1308 ft, involving broken sand. **Producing Area:** 40 acres. **Producing Wells June 30, 1947:** 1 gas. **Rigs Running June 30, 1947:** None. **Deepest Test:** Byrd & Frost's Giesecke-Gulf 1, NE NE NW H&GN 54, Blk 11, failure in granite at 4659-77 ft. **Gas Outlets:** None. **Principal Leaseholders:** Byrd & Frost, Gulf. **Remarks:** No market for gas. Discovery tested 2.2 mln-ft initial.

WESTERMAN
(GAS)

Discovery Data: Geology. **Discovery Well:** E. W. Francis et al's Westerman 1-a, 330 ft s 1650 e of SWc T&StL Ry 28, Blk 146, but in Sect 1, Rubian Phares Sur, Blk 166, completed February 2, 1938. **Type of Structure:** Anticline. **Producing Formations:** Yates sandy-lime 2820-2945 ft. **Producing Area:** 40 acres. **Producing Wells June 30, 1947:** 1 gas. **Rigs Running June 30, 1947:** None. **Deepest Test:** E. R. Minshall's Haynie 1, SW SW NW T&StL Ry 28, Blk 146, failure at 3278 ft. **Gas Outlets:** Southern Union Utilities Co. **Remarks:** One of first gassers in county to be utilized for commercial purposes.

WHITE AND BAKER

Discovery Data: Geology. **Discovery Wells:** Helmerich & Payne's (was Cardinal's) White-Baker 1-C, NE NE NE TC Ry 43, Blk Z, completed January 3, 1935, discovery gasser; ditto's White-Baker 1-36, TC Ry 36, Blk Z, completed 1938, oil-pay discovery; ditto's White-Baker 4-C, 2395 ft nsl and 990 ft ewl TC Ry 44, Blk Z, completed August 8, 1943, as Big Lake lime pay discovery. **Type of Structure:** Anticline. **Producing Formations:** Queen 1628-1976 ft, averaging 26 ft of pay. Big Lake lime 1802-57 ft; 1 well, Queen (gas) 1539-1788 ft, averag'ng 61 ft broken pay. **Producing Area:** Regular: 1440 acres (developed); Big Lake Lime: 40 acres; gas: 400 acres (developed). **Production June 30, 1947:** Daily: 702 bbls. Big Lake lime: dormant. Cumulative: 1,063,207 bbls. Big Lake lime: 17,034 bbls. Estimated remaining reserves: 6,137,000 bbls. **Producing Wells June 30, 1947:** Total: 72 (flowing: 70; artificial lift: 2). **Gravity 30-32. Rigs Running June 30, 1947:** 3. **Deepest Test:** See White & Baker Strawn. **Oil Outlets:** Pasotex P. L. **Gas Outlet:** Helmerich & Payne to Girvin. **Principal Leaseholders:** Helmerich & Payne control field. **Remarks:** Oil production extends east-west 4½ miles; wells are scattered. Considerable development pending. Dry gas generally prevails along south flank of oil area.

WHITE-BAKER STRAWN

Discovery Data: Geology. **Discovery Well:** Helmerich & Payne (Cardinal Dis.'s) White & Baker 8-C, C NE¼ TC Ry 44, Blk Z, completed December 22, 1945. **Type of Structure:** Anticline. **Producing Formations:** Strawn 7612-28 ft, involving 16 ft sand pay. **Producing Area:** 40 acres. **Production June 30, 1947:** Daily: 16 bbls. Cumulative: 21,592 bbls. Estimated remaining reserves: Negligible. **Producing Wells June 30, 1947:** 1 (flowing). **Gravity:** 37.9. **Rigs Running June 30, 1947:** None. **Deepest Test:** Helmerich & Payne's White-Baker 9-C, 670 ft nsl, 659 ft ewl, Sect 44, Blk Z, TC Ry, failure in Ellenburger 9492-10,044 ft. Well was plugged back to make gasser in 1800-ft gas zone. **Oil Outlets:** Pasotex. **Principal Leaseholders:** Helmerich & Payne. **Remarks:** Further development improbable due to small yield of discovery and an offset failure.

YATES

Discovery Data: Surface geology. **Discovery Well:** Ohio's (was Mid-Kansas O&G Co.-Transcontinental Oil Co.) I. G. Yates 1, 2900 ft w of SWc I&GN 60, Blk 1, but in 2485½-ac. vacancy tract, Yates Sur A-8195, October 28, 1926, discovery for lime zone. Clay Johnson et al's Smith 1, GC&SF 24, Blk 194, completed October 10, 1933, discovery of Smith sand zone. **Type of Structure:** Broad elliptical anticlinal dome. **Producing Formations:** San Andres (Perm) lime (main pay) from 602-1892 ft, averaging 113 ft of penetration. Smith Sand (Yates) from 820-1150 ft, averaging 44 ft penetration. Tobarg sand (see Tobarg Field). **Producing Area:** Lime: 20,650 acres. Smith Sand: 680 acres. **Production June 30, 1947:** Daily: Lime, 45,125 bbls. Smith Sand: 206 bbls. Cumulative: Lime: 318,182,531 bbls. Smith Sand: 762 222 bbls. Seepage oil: 3,652,-691 bbls. Estimated remaining reserves: Lime: 341,820,000 bbls. Smith Sand: 360,000 bbls. Seepage: Undetermined. **Producing Wells June 30, 1947:** Total: Lime: 578, (513 flowing). Smith Sand: 18 pumping. **Gravity:** Lime: 28-30. Smith Sand: 30-34. **Rigs Running June 30, 1947:** 2. **Deepest Test:** Standard of Texas Smith-Douglas 1, C SE SE GC&SF 9, Blk 194, west edge of production, failure in Ellenburger 8732-9114 ft. **Oil Outlets:** Humble, Gulf, Shell, Pasotex. **Principal Leaseholders:** M. D. Bryant, Continental, Cooper & Halamicek, Gulf, Mack Hayes, Helmerich & Payne, Humble, Clay Johnson, Ohio Oil, Phillips, Plymouth, James C. Roberts, Savoy Oil Co., Barger & George, Shell, Skelly, Standard of Texas, Stanolind, Tide Water, West Texas Prod. Co. **Remarks:** Recovery from regular lime pay now averages 15,400 barrels per acre. Seepage oil, is obtained from open pits, but this production has dwindled to less than 30 barrel per day. Field has remarkably large natural flowing wells. Currently the largest well is credited with an official potential of 157,830 bbls on open flow at 1400 ft. Production pumped and flowed from shallow porous zones, which have been charged with migratory oil along north and east edges of structure, is credited to the Tobarg field for proration purposes. Deeper production will be developed. One of 3 Ellenburger failures on the west, northeast and southeast flanks of the structure almost qualified as a commercial oil producer from the Ordovician.

REAGAN

BARNHART

Discovery Data: Geophysics. **Discovery Well:** Amerada's University 1-R-A, C SE NE Sect. 3, Blk 48, September 1, 1941. **Type of Structure:** Anticline. **Producing Formations:** Ellenburger dolomite 9010-9155 ft, average 50 ft penetration. Ellenburger 8860-9250 ft, averaging 88 ft of exposed dolomite pay. **Producing Area: 6400** acres. **Production June 30, 1947:** Daily: 4685 bbls. Cumulative: 5,271,736 bbls. Estimated remaining reserves: 33,128,000 bbls. **Producing Wells June 30, 1947:** Total: 45 (flowing: 41; artificial lift: 4). **Gravity:** 43-46. **Rigs Running June 30, 1947:** 1. **Deepest Test:** Amerada's University 1-R-M, C NW NE Sect 6, Blk 48, west edge, and only failure, abandoned in Ellenburger 9122-9394 ft. **Oil Outlets:** Humble. **Principal Leaseholders:** Amerada, General American, Sharples Corp., Skelly. **Remarks:** Developed on 160-acre spacing, excepting few leases, and more inside drilling in prospect to equalize this drainage. Productive area will be expanded along south edge.

BIG LAKE PERMIAN

Discovery Data: Random drilling. **Discovery Well:** Big Lake Oil Co.'s (was Texon Oil & Land Co.) University 1, C SW NE Sect 2, Blk 2, completed May 28, 1923, field discovery in 3000-ft pay. Big Lake's University 17, C NE Sect 1, Blk 2, completed February 9, 1925, 2400-ft pay discovery. Big Lake's University 19-C, 392 ft nsl and 1928 ft ewl Sect 24, Blk 9, completed February 16, 1942, 4300-ft pay discovery. **Type of Structure:** Domal high. **Producing Formations:** Queen sandy-lime 2430-2480 ft, averaging 7 ft of pay. San Andres lime 2860-3100 ft, averaging 23 ft of pay. Clear Fork 4212-4381 ft: 1 well, involving 169 ft of broken pay. **Producing Area:** 3280 surface acres. **Production June 30, 1947:** Daily: 2324 bbls. Cumulative: 74,389,716 bbls (all Permian zones). Estimated remaining reserves: 7,300,-000 bbls. **Producing Wells June 30, 1947:** 176 pumping; 134 wells depleted and plugged. **Gravity: 35-39. Rigs Running June 30, 1947:** None. **Deepest Test:** Discussed under Big Lake Deep. **Oil Outlets:** Reagan County Purchasing Co. to Humble. **Principal Leaseholders:** Big Lake, Continental (Texon). **Remarks:** Field scored first sustained prolific production in Permian Basin, causing the construction of initial pipe line outlet and widespread prospecting. Permian zones have an average crude yield of 22,070 bbls per surface acre, with the bulk derived from the San Andres, while the average crude yield per well is about 240,000 bbls. Further development improbable.

BIG LAKE DEEP

Discovery Data: Drilling without objective. **Discovery Well:** Group One Oil Corp. et al's University 1-B, 250 ft ewl and 88 ft snl SW Sect 36, Blk 9, completed December 12, 1928, discovery of Ellenburger zone. **Type of Structure:** Domal high. **Producing Formations:** Ellenburger 8125-8850 ft, averaging 100 ft of pay. **Producing Area:** 1220 acres. **Production June 30, 1947:** Daily: 840 bbls. Cumulative: 30,295,100 bbls. Estimated remaining reserves: 1,000,000 bbls plus. **Producing Wells June 30, 1947:** Total 18 (flowing: 6; artificial lift: 12). 1 converted to gas; 9 oil wells depleted. **Gravity: 42-58. Rigs Running June 30, 1947:** None. **Deepest Test:** Big Lake's University 13-C, 1470 ft snl and 1110 ft ewl Sect 25, Blk 9, depleted Ellenburger production and deepened to granite at 9853-54 ft, with top of barren Hickory sand at 9740 ft. **Oil Outlets:** Reagan County Purchasing Co. to Humble. **Principal Leaseholders:** Big Lake, Continental (Texon). **Remarks:** Field average in excess of 1 million barrels per well; briefly held producing depth record for world. Opened first Ordovician production for state. Producing zone generally classed as Ellenburger, but undetermined volume of prolific oil and gas flow derived from overlying Crinoidal (Pennsylvanian) lime, which is the production source of the last deep completion. Additional development improbable due to the predominance of water.

GRAYSON

Discovery Data: Subsurface geology. **Discovery Well:** Skelly-Utah Southern's University 1, SWc Sect 33, Blk 8, February 6, 1928. **Type of Structure:** Anticline. **Producing Formations:** San Andres, 3051-3153 ft, average 14 ft pay section. **Producing Area:** 400 acres. **Production June 30, 1947:** Daily: 73 bbls. Cumulative: 791,548 bbls. Estimated remaining reserves: 150,000 bbls. **Producing Wells June 30, 1947:** Total: 6 pumping. **Gravity:** 31-32. **Rigs Running June 30, 1947:** None. **Deepest Test:** Skelly et al's University 1-D, C SW NW 33, topped Cisco 9174 ft, Simpson at 9400 and drilled to 9439 in shale and lime, February, 1935. No shows; well plugged back and completed at 3000-3100 ft. **Oil Outlets:** Humble. **Principal Leaseholders:** Skelly, Superior. **Remarks:** Production includes wildcat marginal pumper 3 miles northwest. Further activity improbable.

GRAYSON NORTHWEST

Discovery Data: Geology. **Discovery Well:** Superior of Calif.-Pete Wiggins-Ed Hyde's University 1-A, C SW NW Sect 25, Blk 8, completed June 5, 1944. **Type of Structure:** Anticline. **Producing Formations:** Grayburg 3135-75 ft, consisting of 40 ft of broken lime pay. **Producing Area:** 40 acres. **Production June 30, 1947:** Cumulative: 2885 bbls. Estimated remaining reserves: Inactive. **Producing Wells June 30, 1947:** 1 pumping. **Gravity:** 32.2. **Rigs Running June 30, 1947:** None. **Deepest Test:** Superior-Wiggins-Hyde's University 1-B-A, NE NE NE Sect 12, Blk 1, failure in Ellenburger 10,060-263 ft. **Oil Outlets:** Trucks. **Principal Leaseholders:** Superior. **Remarks:** Further development improbable. Officially prorated as Grayson field.

MOORE-FRIEND

Discovery Data: Geology. **Discovery Well:** Moore Exploration's W. E. Friend-Standard of Texas 1, 467 ft out of SWc NW¼ Sect 1, Georgetown Ry Sur, completed January 14, 1947. **Type of Structure:** Anticline. **Producing Formations:** San Andres 2390-2538 ft, involving 148 ft of broken pay lime. **Producing Area:** 40 acres. **Production June 30, 1947:** Daily: Not active. Estimated remaining reserves Unimportant. **Producing Wells June 30, 1947:** 1 pumping. **Gravity:** 26. **Rigs Running June 30, 1947:** None. **Deepest Test:** Discovery plugged back from 2582 ft. **Oil Outlets:** Trucks. **Principal Leaseholders:** Moore Exploration. **Remarks:** Discovery pumped only 10 bbls initial and shut in due to small yield and isolation from market. Significant only in that it validates lease with production, pending exploration of deep zones.

REEVES

ANTHONY

Discovery Data: Geology. **Discovery Well:** Far-West Oil Co.'s (was Lagoki Oil Co) Richards-Shaw 1, 660 ft snl and 1320 ft ewl PSL 16, Blk 59, April 24, 1939. **Type of Structure:** Anticline. **Producing Formations:** Upper Castile 1618-30 ft. **Producing Area:** 40 acres. **Production June 30, 1947:** Cumulative: 2460 bbls. Estimated remaining reserves: Depleted. **Gravity:** 30.5. **Deepest Test:** Texas Co.'s Richards-Shaw 1, NW SW SW PSL 16, Blk 59, abandoned 4100 ft. **Remarks:** Discovery flowed 16 bbls initial; later deepened to 1900 ft without production gain, and plugged December 10, 1942.

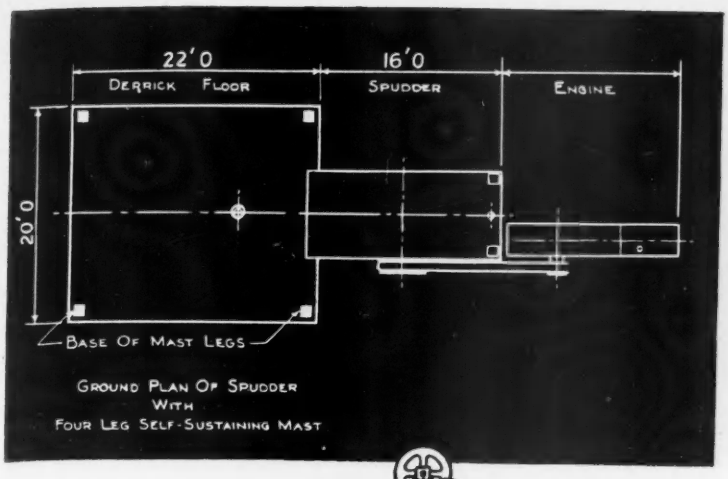
TUNSTILL
(GAS)

Discovery Data: Geology. **Discovery Well:** Pacific-Mid-Continent's (was L. W. Frankley-E. R. Rice) Tunstill 1, NE NE NW T&P Ry 10, Blk 56, Tsp 2, October 9, 1938. **Type of Structure:** Anticline. **Producing Formations:** Delaware 3290-3302 ft, involving 12 ft of gas sand. **Producing Area:** Developed: 40 acres. **Rigs Running June 30, 1947:** 1. **Deepest Test:** General Crude's TXL 1, C NE T&P Ry 15, Blk 56, Tsp 2, indicated 10 bbls oil daily after nitro shot in Delaware at 3250-90 ft, abandoned 3590 ft. **Remarks:** Discovery testing initial 3,770,000 ft gas, with spray of oil, deepened later to 3556 ft, abandoned June 5, 1941 after failing to revive gas in plugging back. Area remains good prospect for small oil field.

SCHLEICHER

OPP

Discovery Data: Geology. **Discovery Well:** H. B. Opp et al's Jackson 1, 1065 ft from nl 2070 ft from el TC 40, Blk LL, September 2, 1939. **Type of Structure:** Anticline. **Producing Formations:** Cisco lime 4049 ft (broken saturation). **Producing Area:** 40 acres. **Production June 30, 1947:** Daily: Dormant. Cumulative: 3200 bbls. Estimated remaining reserves: Negligible. **Producing Wells June 30, 1947:** 1 dormant. **Gravity:** 34. **Rigs Running June 30, 1947:** None. **Deepest Test:** Discovery deepened to 6155 ft in Permian, then temporarily abandoned January, 1942. **Principal Leaseholders:** Opp Estate. **Remarks:** Small initial production well temporarily abandoned after deepening to 6155 with negative results. Well is important, however, in that production was found in area remote from established fields.



GROUND PLAN OF SPUDDER WITH FOUR LEG SELF-SUSTAINING MAST

YOUNG MODEL 6 SPUDDER

2,000 ft. to 6,000 ft. Drilling

For as near to perfect operation as you can get. For the easy portability you have wanted.

Model 6 can be powered by **any Drilling Engine** which has sufficient power for 6,000 ft. drilling with a belt to the shaft of the spudder. This arrangement permits the engine to be moved separately and simplifies servicing. The fire hazard is reduced because the engine can be as far from the hole as the belt permits.

The Rear Axle with four 11.00 x 20 pneumatic tires on 82" track gives stability on roads. The axle can be reduced to 72" track if necessary. This spudder can also be furnished skid-mounted. Low center of gravity reduces the possibility of upsetting. Frame is 17' long, 8' wide overall. A tractor hitch is provided at the front.

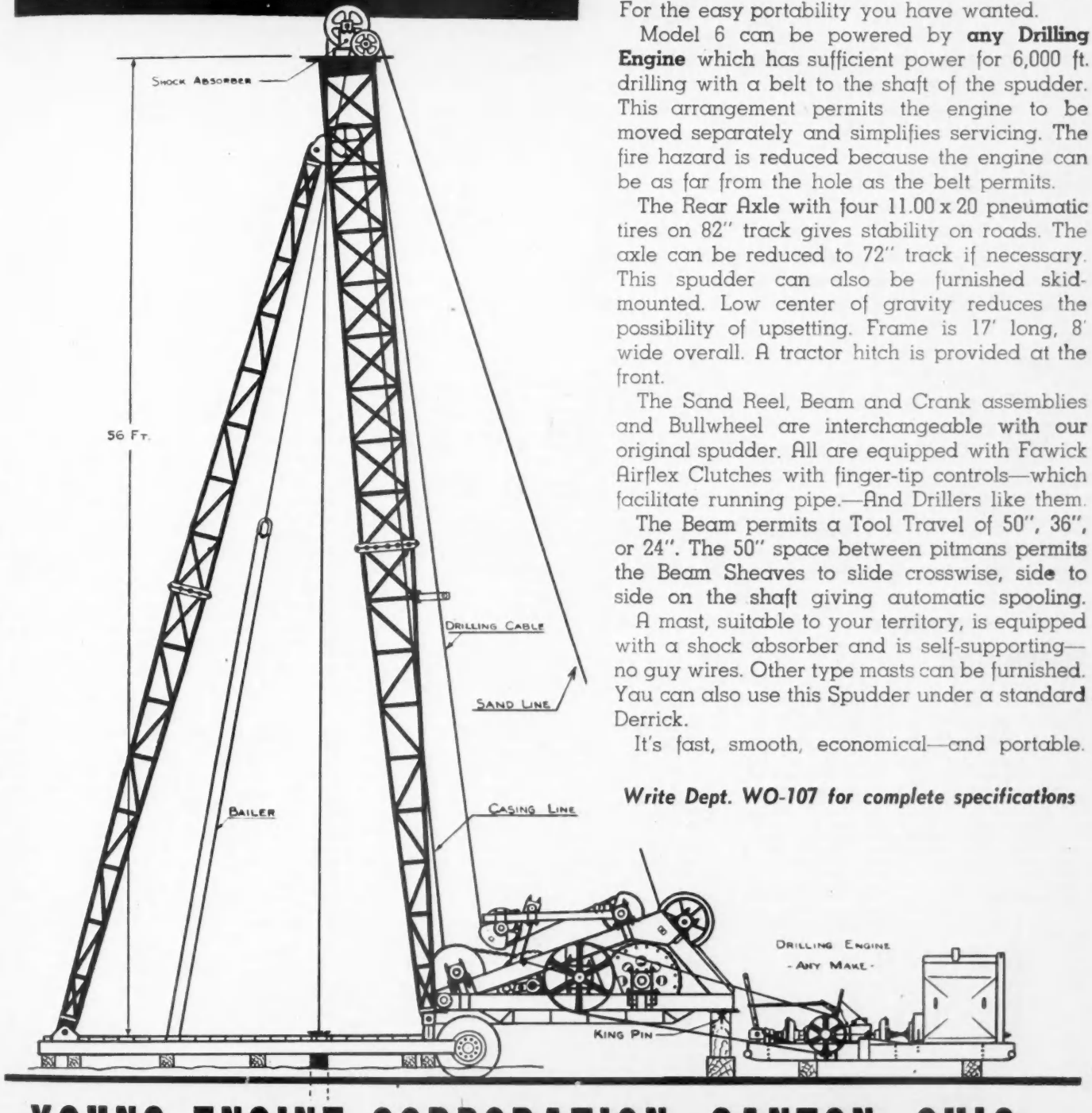
The Sand Reel, Beam and Crank assemblies and Bullwheel are interchangeable with our original spudder. All are equipped with Fawick Airflex Clutches with finger-tip controls—which facilitate running pipe.—And Drillers like them.

The Beam permits a Tool Travel of 50", 36", or 24". The 50" space between pitmans permits the Beam Sheaves to slide crosswise, side to side on the shaft giving automatic spooling.

A mast, suitable to your territory, is equipped with a shock absorber and is self-supporting—no guy wires. Other type masts can be furnished. You can also use this Spudder under a standard Derrick.

It's fast, smooth, economical—and portable.

Write Dept. WO-107 for complete specifications



YOUNG ENGINE CORPORATION, CANTON, OHIO

Make Your Drilling Dollars Go Deeper

PAGE

Discovery Data: Geology. **Discovery Well:** Cooper Gas Co.'s (was Geo. T. Wilson et al) Page 1-A-40, 1290 ft snl and 1470 ft ewl GH&SA 40, Blk L, completed October 15, 1935 gas discovery. Cooper's (was Lone Star Gasoline Co) Page-Humble 1-C-30, 1595 ft wel and 660 ft snl GH&SA 30, Blk L, completed June 18, 1939 as oil discovery on south flank of field. **Type of Structure:** Anticline. **Producing Formations:** Strawn (oil) 5520-5746 ft; 11 (oil), averaging 44 ft pay. Strawn (gas) 5380 5541 ft; 7 (gas), averaging 67 ft of gas pay. **Producing Area:** Developed (oil): 440 acres. Proved and prospective: 960 acres. **Production June 30, 1947:** Daily: 1030 bbls. Cumulative: 233,300 bbls. Estimated remaining reserves: 2,407,000 bbls. **Producing Wells June 30, 1947:** Total: 11 oil (flowing 7; artificial lift: 4). **Gravity:** 40-43. **Deepest Test:** Discovery plugged back from 6257 ft. **Oil Outlet:** Cooper Gas Co. to Shell. **Gas Outlet:** Lone Star. **Principal Leaseholders:** Cooper Gas Co., Geo. D. Morgan. **Remarks:** Oil produced from southwest flank (1 well) and northwest sector of the gas field. Gas yields 3/10 gallons of gasoline per 100 ft of gas. Outlying failures virtually define field, with oil production due to be expanded to northeast.

SCURRY-MITCHELL

SHARON RIDGE "1700"

Discovery Data: Geology. **Discovery Well:** Coffield & Guthrie's (was Northwest Co., previously Loutex Corp.) J. J. Moore 1, NW NW SW H&TC 116, Blk 97, June, 1923. **Type of Structure:** Anticline. **Producing Formations:** San Andres 1538-1960 ft, averaging 88 ft of broken lime pay. **Producing Area:** Developed: 4000 acres. **Production June 30, 1947:** Daily: 1650 bbls. Cumulative: 1,690,272 bbls. Estimated remaining reserves: 14,310,000 bbls. **Producing Wells June 30, 1947:** 212 pumping. **Gravity:** 26-30. **Rigs Running June 30, 1947:** 19. **Deepest Test:** Northwest Co.'s Stinson 1, NE NW NW H&TC 101, Blk 97, plugged back from Clear Fork at 4520 ft. **Oil Outlets:** Coffield & Guthrie, to Col-Tex's plant. **Principal Leaseholders:** American Trading & Prod., Jas. H. Beall et al, Beard-Tullos, O. R. Bolinger, J. G. Bristow, Coffield-Guthrie, C. L. Echols, A. E. Dennis, K. A. Ehman, First National Bank of Wichita Falls, A. B. Forster, Four W Oil Co., E. L. Goos, E. J. Gray, Holden & Roberts, LeMay Oil Co., C. T. McLaughlin, Magnolia, Minosa Oil, John Odstrcil, W. N. Pearson, W. C. Russell, Robertson-McKissick, H. W. Snowden, Townsend & Thomas, Wasson Oil Co., I. Weiner. **Remarks:** Early development in northwest sector where small wells predominate; but series of southeast and east extensions, beginning in 1940, opened more attractive production. Market for oil also progressively improved, thus encouraging drilling. Currently one of the most active drilling areas. Ten-acre spacing adhered to by 45 wells, while remainder on 20-acre pattern. Considerably more development in store for field.

SCURRY

SHARON RIDGE

Discovery Data: Geology. **Discovery Well:** D. & R. Oil Co.'s (was Robinson Drlg. Co.) Martin 1, C NW SW H&TC 147, Blk 97, completed January 14, 1938, field discovery in the San Angelo. Parten Drlg. Co.'s (was J. G. Bristow-R. H. Cantrill) Tomlinson 1, NE NE SE H&TC 122, Blk 97, completed 1939 Clear Fork pay discovery. **Type of Structure:** Anticline. **Producing Formations:** San Angelo 2145-2560 ft, averaging 156 ft of broken lime pay. Clear Fork 2875-3256 ft, averaging 140 ft of broken lime pay. **Producing Area:** 2200 acres (developed). **Production June 30, 1947:** Daily: 500 bbls. Cumulative: 1,564,730 bbls. Estimated remaining reserves: 1,735,000 bbls. **Producing Wells June 30, 1947:** 125 pumping. **Gravity:** 25-30. **Rigs Running June 30, 1947:** None. **Deepest Test:** Landreth Prod. Corp's Hillmer 1, NE NE NE H&TC 75, Blk 25, failure in Clear Fork at 4290 ft. **Oil Outlets:** Coffield & Gutherie's to Col-Tex Ref.'s refinery. **Principal Leaseholders:** Geo. S. Allison et al, Blue Streak, Byrd & Frost, Coffield & Guthrie, D. R. Oil Co., Helmerich & Payne, Magnolia, Mudge, Pearson-Sibert Oil Co., Robinson Oil Corp., H. W. Snowden, J. B. Stoddard. **Remarks:** Field's average crude yield per acre not in proportion to development costs, thus accounting for lagging operations. Thirty wells drilled on 10-acre spacing and less.

STERLING

CLARK

Discovery Data: Geology. **Discovery Well:** H. D. Rummel-Kanawah-Angelo Oil Co.'s L. T. Clark 3, C E½ NE¼ GC&SF Ry 8, Blk A, completed October 1926. **Type of Structure:** Unidentified. **Producing Formations:** Permian lime 1173 to 1175 ft. **Producing Area:** 40 acres. **Production June 30, 1947:** None. Estimated remaining reserves: Depleted. **Producing Wells June 30, 1947:** None. **Gravity:** 32. **Remarks:** Pumped 2 bbls 32-gravity oil daily for brief period, then abandoned.

SUTTON

ALLISON

Discovery Data: Geology. **Discovery Well:** S. B. Roberts-M. C. Moore's Geo. S. Allison 2, C NW SW GH&SA Ry 25, Blk K, completed December 17, 1942. **Type of Structure:** Anticline. **Producing Formations:** Canyon (Palo Pinto) 3670-3761 ft, averaging 31 ft broken pay. **Producing Area:** Developed: 80 acres. **Producing Wells June 30, 1947:** 2 gas. **Rigs Running June 30, 1947:** None. **Deepest Test:** Discoverers' King 1, SE SE SW GH&SA Ry 26, Blk K, plugged back from Ellenburger at 5035-5475 ft for gas. **Gas Outlets:** None. **Principal Leaseholders:** Discoverers. **Remarks:** The elimination of deeper prospective pays discourages development until market available for sweet gas.

SHELL-WILSON
(GAS)

Discovery Data: Geophysics. **Discovery Well:** Shell's Duke Wilson 1, C NW SE TW&NG Ry 38, Blk B-14, completed May 27, 1946. **Type of Structure:** Anticline. **Producing Formations:** Strawn at 4194-4215 and 4220-45 ft, totalling 180 ft of broken lime pay. **Producing Area:** 40 acres. **Producing Wells June 30, 1947:** 1 gas (shut in). **Rigs Running June 30, 1947:** None. **Deepest Test:** Discovery plugged back from 6170 ft. **Gas Outlets:** None. **Principal Leaseholders:** Shell controls 6080-acre lease. **Remarks:** Situated 20 mi south of production (gassers); no market for gas; no incentive to continue development.

TERRY-GAINES

ADAIR

Discovery Data: Geophysics-geology. **Discovery Well:** Amerada's Sam Adair 1, C SW SW PSL 4, Blk C-37, completed May 1, 1947. **Type of Structure:** Anticline. **Producing Formations:** San Andres 4802-4945 ft, averaging 81 ft broken lime pay. **Producing Area:** Developed: 200 acres. **Production June 30, 1947:** Daily: 500 bbls. Cumulative: 10,743 bbls. Estimated remaining reserves: 1,189,000 bbls. **Producing Wells June 30, 1947:** Total: 5 (flowing: 1; artificial lift: 4). **Gravity:** 33.1. **Rigs Running June 30, 1947:** 4. **Deepest Test:** Amerada's Elkins 1, west offset to discovery, plugged back from water in San Andres at 4955 ft. **Oil Outlets:** Trucks, Stanolind has authorized connection. **Principal Leaseholders:** Amerada, Tide Water. **Remarks:** Productive area may be expanded to 1200 acres or more.

TERRY

ALEX

Discovery Data: Geology. **Discovery Well:** Honolulu's (was Leland Fikes-John Murchison) C. R. Alexander 1, 670 ft snl and 542 ft ewl PSL 18, Blk K, completed January, 1945. **Type of Structure:** Anticline. **Producing Formations:** San Andres 5099-5157 ft, averaging 36 ft of pay. **Producing Area:** Developed: 160 acres. **Production June 30, 1947:** Daily: 145 bbls. Cumulative: 35,556 bbls. Estimated remaining reserves: 845,000 bbls. **Producing Wells June 30, 1947:** Total: 4 (flowing: 1; artificial lift: 3). **Gravity:** 30-33. **Rigs Running June 30, 1947:** None. **Deepest Test:** Geo. P. Livermore-Honolulu's Abilene Bank-Texaco 1, C SW SW C&M 16, Blk D-14, failure at 5253 ft. **Oil Outlets:** Stanolind. **Principal Leaseholders:** Honolulu, T. P. Coal & Oil. **Remarks:** Productive area virtually defined by failures and low wells.

TOM GREEN

FUNK

Discovery Data: Geology. **Discovery Well:** Texas Mineral Land Co.'s (was B. C. Mann et al) Joe Funk 1, NE NW NE H&TC 32, Blk 5, May 22, 1940. **Type of Structure:** Anticline. **Producing Formations:** Permian (Blaine) limestone 1104-75 ft, averaging 6 ft of pay. **Producing Area:** Depleted. **Production June 30, 1947:** Cumulative: 7350 bbls. Estimated remaining reserves: Depleted. **Gravity:** 33. **Deepest Test:** Discovery plugged back from Clear Fork at 1562 ft. **Remarks:** Homer W. Snowden Interests (Texas Mineral Land Co.-C. & Oil Co.) acquired the dormant discovery well and supporting block March, 1943, then proceeded to drill 17 adjacent wells simultaneously. This resulted in 10 failures and 7 pumpers, which failed to maintain commercial yield regularly. Field abandoned.

UPTON-CRANE

CRANE-COWDEN

Discovery Data: Geology. **Discovery Well:** Marland Oil's Benton 1, 300 ft out of SWc Sect. 1, Julia Prater Sur, Upton County. **Type of Structure:** Anticline. **Producing Formations:** Grayburg 2200-2650 ft, averaging 62 ft of penetration. **Producing Area:** 2300 acres (scattered). **Production June 30, 1947:** Daily: 240 bbls. Cumulative: 6,033,900 bbls. Estimated remaining reserves: 400,000 bbls. **Producing Wells June 30, 1947:** 85 pumping, 60 depleted. **Gravity:** 28-30. **Rigs Running June 30, 1947:** None. **Deepest Test:** Gulf's Starnes 1, 660 ft wel and 3300 ft nsl Sect. 1, J. R. Prater Sur A-351, failure in Montoya 7885-7933 ft; pb to regular pay. **Oil Outlets:** Humble, Shell. **Principal Leaseholders:** Walter Carr, Conoco, E. & B. Prod. Co., Gilcrease, Helmerich & Payne, Chas. H. Marsh, J. W. Perry, E. G. Rodman, Star Oil Co., Superior, Texas. **Remarks:** Most of wells are strippers. Further development of no consequence. Area is a continuation of McCamey field, but prorated separately.

McCAMEY

Discovery Data: Surface Geology. **Discovery Well:** Republic Pet's (was J. P. Johnson-Geo. B. McCamey-Marland Oil Co.) M. L. Baker 1, e cor N¼ Sect. 8, E. C. Groom Sur, September 30, 1925. **Type of Structure:** Anticline. **Producing Formations:** Permian lime 1910-2800 ft, averaging 64 ft penetration. **Producing Area:** 20,500 acres. **Production June 30, 1947:** Daily: 9100 bbls. **Cumulative:** 71,367,012 bbls. Estimated remaining reserves: 23,780,000 bbls. **Producing Wells June 30, 1947:** Total: 881 (flowing: 2; pumping 879). **Gravity:** 26-30. **Rigs Running June 30, 1947:** 2. **Deepest Test:** See McCamey-Silurian field. **Oil Outlets:** Humble, Shell. **Principal Leaseholders:** Amerada, Adkinson, Atlantic, C. W. Brown, Burk Roy. Co., Continental, Devore et al, J. W. Ellis, General American, Gulf, Helmerich & Payne, J. M. Hickey, Humble, Intercoast Pet., Magnolia, C. E. Marsh, McAlester Fuel, Pure, Reno Oil Co., Rutter & Wilbanks Bros., Senate Oil Co., Shell, Stanolind, Sun, T&P Coal & Oil. **Remarks:** Substantial portion of original field was in preliminary stage of abandonment during late 1920's when acid treatment was introduced as a means of converting non-commercial wells to profitable pumpers. Nominal volume of development will continue.

McELROY

Discovery Data: Random drilling. **Discovery Well:** Magnolia's (was Church & Fields) University 1, NW SE SE Sect. 34, Blk. 30, completed April 19, 1926, as discovery for Church & Fields, or University Lands sector. Gulf's McElroy 1, SE SE SE Sect. 203, Blk. F, CCSD&RGNG Sur, completed July 19, 1926, as discovery for original McElroy field. **Type of Structure:** Anticline. **Producing Formations:** Grayburg 2578-3289 ft, averaging 155 ft of porous lime. **Producing Area:** Developed, 15,480 acres. **Production June 30, 1947:** Daily, 30,732 bbls.; Cumulative, 169,510,000 bbls.; Estimated remaining reserves, 78,170,000 bbls. **Producing Wells June 30, 1947:** Total, 711 (flowing, 72; artificial lift, 639). **Gravity:** 29-33. **Rigs Running June 30, 1947:** 9. **Deepest Test:** Gulf's McElroy 103, C NW SW Sect. 197, Blk F, CCSD&RGNG Sur, Upton County, failure in Ellenburger at 12,391-786 ft.; plugged back to regular pay for completion. **Oil Outlets:** Gulf, Humble, Texas-New Mexico. **Principal Leaseholders:** Amerada, Atlantic, Cities Service, Roy D. Golston, Gulf, Humble, Kenwood Oil, Kewanee, Mabee, Magnolia, Phillips, Shell, Sinclair Prairie, Texas Co., Texas-Pacific, Tidewater. **Remarks:** McElroy field involves consolidation of Church & Fields, Gulf-McElroy, Eddleman and McClintic by special order of the Commission on March 7, 1941. Gulf's McElroy ranch sector will receive considerable additional development. University Lands sector of field (north end) has produced 66,600,000 bbls. to date. Texas Co.'s (was Landreth Production Corp) State 11 has produced approximately 7,000,000 bbls. of oil, and currently is prorated to a base allowable of 283 bbls. daily.

UPTON

HURDLE

Discovery Data: Trend drilling. **Discovery Well:** F. W. Merrick's (was Brewer-Smith) Cordova Union Oil Corp. 1, SEc E ½ NW MK&T 19, Blk 1, June 12, 1936. **Type of Structure:** Anticline. **Producing Formations:** Grayburg 2030-2100 ft, average 40 ft penetration. **Producing Area:** 240 acres. **Production June 30, 1947:** Daily: 27 bbls. Cumulative 292,765 bbls. Estimated remaining reserves: Negligible. **Producing Wells June 30, 1947:** 12 pumping. **Gravity:** 24-27. **Rigs Running June 30, 1947:** None. **Deepest Test:** See McCamey Silurian. **Oil Outlets:** Shell. **Principal Leaseholders:** Atlantic. **Remarks:** Area is related to the McCamey district, although isolated from same by failures.

BETHLEHEM
Drop Forgings

FURNISHED IN MANY SIZES, SHAPES, WEIGHTS

Whenever you require drop forgings, Bethlehem has much to offer you.

We show here only a small fraction of the great variety that Bethlehem turns out yearly. Our complete list of drop-forging designs covers a broad range of sizes, weights, and types, and includes such things as connecting rods, valve bodies, journals; parts for mechanical tools, aircraft, and oil-field equipment; and many other items too numerous to mention here.

Bethlehem is equipped with steam and board drop hammers rated from 1500 to 8000 lb, mechanical forging presses up to 2000 tons, and upsetters 9 in. and smaller—all backed by the most modern and extensive heat-treating facilities. Ask for details.

BETHLEHEM STEEL COMPANY
Bethlehem, Pa.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

Export Distributor: Bethlehem Steel Export Corporation

★ BETHLEHEM STEEL ★

McCAMEY SILURIAN

Discovery Data: Geology. **Discovery Well:** TP Coal & Oil's J. F. Lane 52-A, SW NE SE GC&SF Ry 5, A-213, completed November 25, 1943. **Type of Structure:** Anticline. **Producing Formations:** Silurian 7125-7200 ft, involving 3 zones of perforation aggregating 75 ft of broken pay. **Producing Area:** 40 acres. **Production June 30, 1947:** Daily: 16½ bbls. Cumulative: 23,844 bbls. Estimated remaining reserves: 30,000 bbls. **Producing Wells June 30, 1947:** 1 flowing. **Gravity:** 43-44. **Rigs Running June 30, 1947:** None. **Deepest Test:** Discovery plugged back from Ellenburger at 8195-8358 ft. **Oil Outlets:** Humble. **Principal Leaseholders:** T. P. Coal & Oil. **Remarks:** Discovery settled to 16½ bbls oil daily and has maintained this rate more than 2 years. Thick zone of Devonian passed up without test, not being source of production in Permian Basin at that time. Important Pre-Permian production from series of highs anticipated, thus accounting for demand for deep mineral rights.

UPLAND

Discovery Data: Geophysics. **Discovery Well:** Humble's J. M. Parrott 1, C SE SE EL&RR. 3, completed July 7, 1945. **Type of Structure:** Anticline. **Producing Formations:** Basal Permian 9100-9893 ft, with thin streaks of porosity at intervals in 793-ft broken lime zone. **Producing Area:** 40 acres. **Production June 30, 1947:** Cumulative: 1075 bbls. Estimated remaining reserves: Depleted. **Producing Wells June 30, 1947:** None. **Gravity:** 42.3. **Deepest Test:** Discovery lost returns in chert at 10,744 ft, total depth; PB for completion through perforations opposite thin streaks of pay. **Oil Outlets:** Tank trucks. **Principal Leaseholders:** Humble. **Remarks:** No additional explorations for area likely.

WEBB RAY

Discovery Data: Subsurface geology. **Discovery Well:** Webb-Ray Oil Co.'s Cordova Union Oil Corp. 1, 2518 ft w and 17½ ft n of NWc GC&SF 8, but in Sect. 3, Blk AB, A. E. Baxley Sur, November 19, 1935. **Type of Structure:** Anticline. **Producing Formations:** Grayburg 2061-2125 ft, averaging 20 ft of lime pay. **Producing Area:** 40 acres. **Production June 30, 1947:** Daily: 10 bbls. Cumulative: 69,770 bbls. Estimated remaining reserves: Negligible. **Producing Wells June 30, 1947:** 1 pumping. **Gravity:** 26-27. **Rigs Running June 30, 1947:** None. **Deepest Test:** See McCamey Silurian. **Oil Outlets:** Shell. **Principal Leaseholders:** Kenwood Oil. **Remarks:** No additional development in prospect. Involves local high that is related to McCamey structure.

WARD

BYRD

Discovery Data: Geology. **Discovery Well:** Stanolind's H. L. Byrd 1, C E¼ N¼ H&TC 34, Blk 34, March 17, 1942. **Type of Structure:** Reef. **Producing Formations:** Yates 2580-2679 ft, averaging 34½ ft of penetration. **Producing Area:** 280 acres. **Production June 30, 1947:** Daily: 56 bbls. Cumulative: 167,986 bbls. Estimated remaining reserves: 672,000 bbls. **Producing Wells June 30, 1947:** Total: 7 (flowing: 5; artificial lift: 2). **Gravity:** 28-32. **Rigs Running June 30, 1947:** None. **Deepest Test:** Stanolind's Coons 1, C S¼ W¼ H&TC 35, Blk 34, failure at 3200 ft. **Oil Outlets:** Atlantic. **Principal Leaseholders:** Stanolind. **Remarks:** Minor expansion possible to northwest and southeast.

DOBBS

Discovery Data: Subsurface geology. **Discovery Well:** Duffey Oil Co.'s (was Dobbs Oil Co.) A. F. Bray-Gulf 1, 1650 ft from swl 2310 ft from sel H&TC 14, Blk 5, January 8, 1936. **Type of Structure:** Anticline. **Producing Formations:** Permian sandy lime 2550-63 ft. **Producing Area:** 40 acres. **Production June 30, 1947:** Daily: 5 bbls. Cumulative: 27,266 bbls. Estimated remaining reserves: Negligible. **Producing Wells June 30, 1947:** Total: 1 pumping. **Gravity:** 36. **Rigs Running June 30, 1947:** None. **Deepest Test:** Discussed under South Ward District. **Oil Outlets:** Atlantic. **Principal Leaseholders:** Duffey Oil Co. **Remarks:** One of the 2 completed oil wells abandoned. Further development improbable due to failures.

GULF-EDWARDS

Discovery Data: Geology. **Discovery Well:** Gulf's Edwards 2-B-T, 330 ft from se 3696 ft fr nel of James M. Andrews Sur 6, completed February 27, 1945. **Type of Structure:** Anticline. **Producing Formations:** Glorietta (Holt) 4386-4562 ft, involving 176 ft of broken sandy-lime pay. **Producing Area:** 40 acres. **Production June 30, 1947:** Daily: Depleted. Cumulative: 834 bbls. Estimated remaining reserves: None. **Gravity:** 36.4. **Deepest Test:** Gulf's J. Edwards 1-E, 2043 ft nsl and 660 ft wel PSL 1, Blk B-19, 1¼ mi ne of discovery, failure in Ellenburger at 10,532-862 ft. **Oil Outlets:** None. **Principal Leaseholders:** Gulf. **Remarks:** Plugged due to sharp production drop and gain in water. Further development improbable, unless for deeper zones.

LION

Discovery Data: Geology. **Discovery Well:** Lion's University 1-B, C NE NE Sect. 43, Blk 18, completed October 25, 1944. **Type of Structure:** Anticline. **Producing Formations:** Delaware (oil) 4975-95 ft, averaging 17 ft sand. Delaware (gas) 4941-95 ft; 2 wells, averaging 1½ ft sand. **Producing Area:** Developed (oil): 80 acres. Gas 80 acres. **Production June 30, 1947:** Daily: 65 bbls. Cumulative: 31,683 bbls. Estimated remaining reserves: 248,000 bbls. **Producing Wells June 30, 1947:** 2 flowing. **Gravity:** 35. **Rigs Running June 30, 1947** 1. **Deepest Test:** Lion's University 7-B, SW SW NW Sect. Blk 18, plugging back from 6490 feet (Delaware). **Oil Outlets:** Trucks. **Principal Leaseholders:** Lion controls with 3690-ac lease. **Remarks:** Destined to be small producing area.

MAGNOLIA SEALY

Discovery Data: Random drilling. **Discovery Well:** Magnolia's Sealy 1, NE NE SW GMMB&A 46, Blk F, November 24, 1930. **Type of Structure:** Anticline. **Producing Formations:** Yates 2740-2850 ft, average 45 ft penetration. Seven Rivers 3000-75 ft, average 20 ft penetration. **Producing Area:** 540 acres. **Production June 30, 1947:** Daily: 196 bbls. Cumulative: 1,508,844 bbls. Estimated remaining reserves: 651,000 bbls. **Producing Wells June 30, 1947:** 51 pumping; 3 depleted. **Gravity:** 29-37, average 34. **Rigs Running June 30, 1947:** None. **Deepest Test:** Gulf's O'Brien 135, NW SW NW GMMB&A 36, Blk F, failure in Seven Rivers at 3166 ft. **Oil Outlets:** Atlantic. **Principal Leaseholders:** Gulf, McQueen & Clevenger, Magnolia, Mid-Continent, Sinclair Prairie. **Remarks:** Development conducted on 10-acre pattern; majority of wells are marginal pumpers. Some leases warrant additional drilling.

MAGNOLIA SEALY SOUTH

Discovery Data: Subsurface geology and trend. **Discovery Wells:** Magnolia's Sealey 2-43, SW NE NE G&MMB&A 43, Blk F, completed February 8, 1940, field discovery. Atlantic et al's University-Wickett 1, C SW NE Sect. 12, Blk 16, May 17, 1940, discovery of south sector and 3 miles from above. **Type of Structure:** Narrow reef. **Producing Formations:** Seven Rivers 2887-2937 ft, averaging 4½ ft of perforations and open hole. **Producing Area:** 720 acres (assigned). **Production June 30, 1947:** Daily 360 bbls. Cumulative: 1,266,540 bbls. Estimated remaining reserves: 1,614,000 bbls. **Producing Wells June 30, 1947:** 19 (flowing: 12; artificial lift: 7). **Gravity:** 27-29. **Rigs Running June 30, 1947:** None. **Deepest Test:** Gulf's O'Brien 141, SE NE NW Sect. 39, Blk F, failure at 3578 ft. **Oil Outlets:** Atlantic. **Principal Leaseholders:** Atlantic, Magnolia. **Remarks:** Production extends 3¾ miles northsouth, with maximum width of 2 locations. An abundance of gas overlies the oil zone.

MONAHANS ELLENBURGER

Discovery Data: Geophysics. **Discovery Well:** Shell's Sealy-Smith 1, NE NE SE G&MMB&A 38, Blk A, completed August 7, 1942. **Type of Structure:** Anticline. **Producing Formations:** Ellenburger 10,062-422 ft, averaging 215 ft of effective dolomite pay. **Producing Area:** 1120 acres (160-ac units). **Production June 30, 1947:** Daily: 1978 bbls (base allowable). Cumulative: 1,259,827 bbls. Estimated remaining reserves: 9,940,000 bbls. **Producing Wells June 30, 1947:** 7 flowing. **Gravity:** 46-50. **Rigs Running June 30, 1947:** 1. **Deepest Test:** Discovery plugged back from 10,545 ft, or 463 ft in Ellenburger. **Oil Outlets:** Shell. **Principal Leaseholders:** Shell controls with 19,725-acre lease. **Remarks:** Two upper pays discussed under separate listing. No failures; apex of Ellenburger structure to date established by Sealy-Smith 10, but steep dip prevails to east. Silurian production showed promise in some Ellenburger wells. Using 160-acre spacing for Ellenburger wells.

MONROE

Discovery Data: Surface geology. **Discovery Well:** Plains Prod. Co. et al's (was Shipley Oil Corp.-D. H. Byrd & H. A. Harmon) Lee Monroe 1-A, 220 ft out w cor W&NW Ry 3, Blk 1, completed November 21, 1931. **Type of Structure:** Fold in Delaware. **Producing Formations:** Delaware sand, 4663-73 ft, involving 10 ft of pay. **Producing Area:** 40 acres. **Production June 30, 1947:** Daily: 18 bbls. Cumulative: 99 954 bbls. Estimated remaining reserves: 40.000 bbls. **Producing Wells June 30, 1947:** 1 flowing. **Gravity: 29. Rigs Running June 30, 1947:** None. **Deepest Test:** Ten Bell Oil Co.'s (was L. F. White-A. R. Eppenauer) Monroe-Rector 1, 330 ft out e cor W&NW 3, Blk 1, 1¼ mi E of discovery, plugged at 4710 ft after flowing briefly. **Oil Outlets:** Tank trucks. **Principal Leaseholders:** Plains Production et al. **Remarks: Four outlying failures are situated a mile or more from discovery, which has maintained unusually long and undiminishing flow.**

PRUITT

Discovery Data: Geophysics. **Discovery Well:** Fred Hyer et al's (was J. E. Fitz-Patrick et al) Pruitt 1, 467 ft out s cor W&NW Ry 23, Blk 1, completed July 6, 1942. **Type of Structure:** Anticline. **Producing Formations:** Delaware sd at 4831-69 ft, involving 38 ft of broken pay. **Producing Area:** 40 acres. **Production June 30, 1947:** Daily: Dormant. Cumulative 3422 bbls. Estimated remaining reserves: Dormant. **Producing Wells June 30, 1947:** Inactive. **Gravity** 32. **Rigs Runnings June 30, 1947:** None. **Deepest Test:** None. **Oil Outlets:** Trucks. **Remarks:** Production declined to nonprofitable volume.

PYOTE

Discovery Data: Geology. **Discovery Well:** Sunray's (was Darby Pet.) University 1, C SE SW Sect 19, Blk 16, completed March 25, 1942. **Type of Structure:** Reef. **Producing**

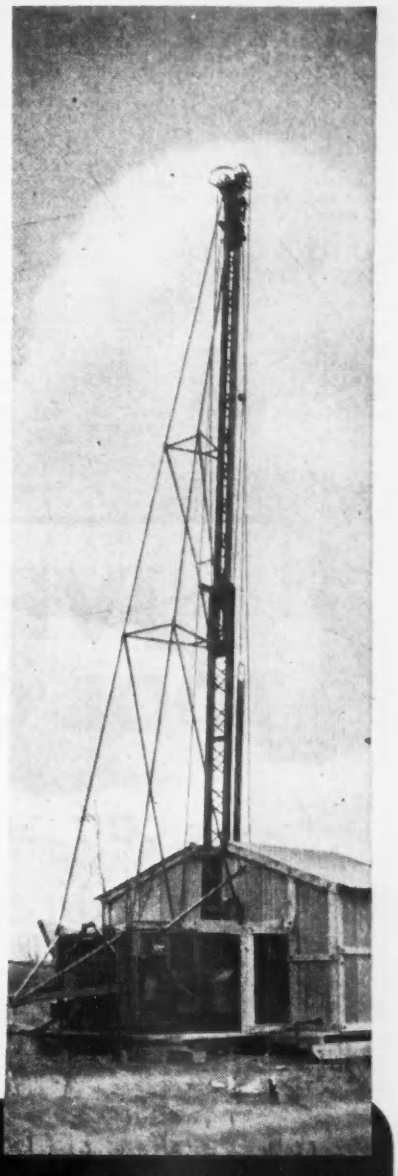
one or more of this famous line of portable, gasoline-engine powered units is on the job daily — and nightly — in all kinds of weather in scores of major fields. HOMELITE *'carryable'* equipment, weighing from 48 to 95 pounds, is sold by on-the-job demonstrations. For arrangements, contact

HOMELITE CORPORATION

in the Southwest:
HOUSTON • DALLAS
3904 Burch P-7371 — 3400 Ross T-2359

JOB-TO-JOB *or* ON-THE-JOB YOU CAN MAKE *FAST* MOVES

with Bucyrus-Erie Spudders



Contractors who place a premium on time consumed in rigging up, tearing down, and moving from job-to-job choose versatile Bucyrus-Erie spudders for getting those quick set-up and location changes that mean added profits. Bucyrus-Eries can be moved quickly, not as a caravan, but in one compact unit mounted on truck, trailer, semi-trailer, or skid to get you to your next job in the shortest possible time.

And once on the job, there's no delay, because with everything handy and with their easy-working telescoping derricks, Bucyrus-Eries can be set up in a surprisingly short time — the entire setup can be made in a few hours.

Coupled with the outstanding mobility of these modern all steel rigs is the speed with which they put down hole . . . the smooth, easy operation that enables them to give you more efficient performance in top-to-bottom drilling, tailing-in, swabbing and other servicing operations.

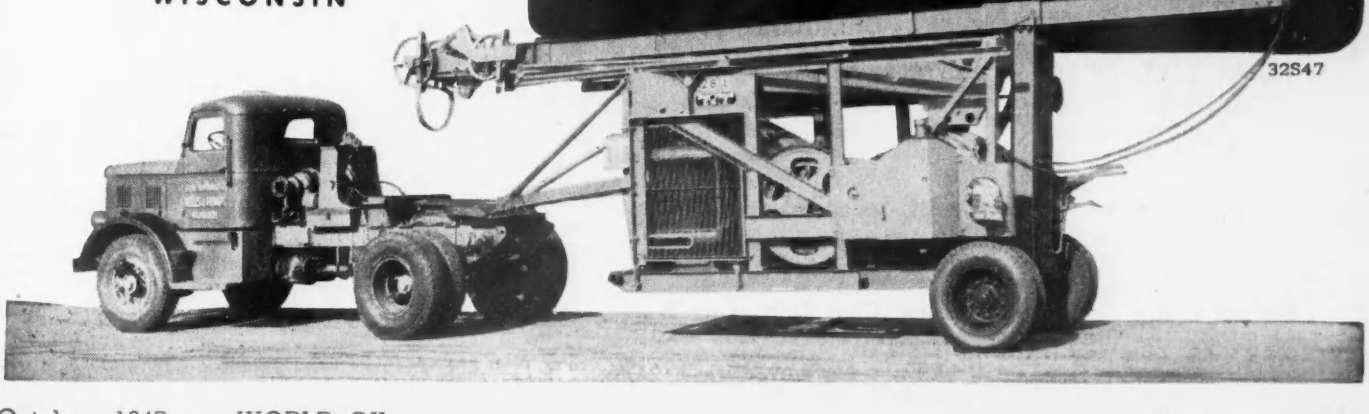
For big capacity spudders capable of handling your varied jobs and handing you steady profits, select Bucyrus-Eries! Ask for details on the 48-L, 36-L, 28-L, and 24-L models.

Bucyrus-Erie

SOUTH MILWAUKEE
WISCONSIN

DISTRIBUTED BY:

IVERSON TOOL CO.	Tulsa, Okla., Odessa, Tex., Artesia, N. M.
BEACON SUPPLY CO.	Borger and Pampa, Texas
BECKWITH MACHINERY CO.	Bradford, Penna.
THE McJUNKIN SUPPLY CO.	Charleston, W. Va.
RANDALL-ZOGG SUPPLY CO.	Owensboro, Ky.
ZANESVILLE TOOL & SUPPLY CO.	Zanesville and Wooster, Ohio
THE STRAKER SUPPLY	Mt. Pleasant, Mich.
GREAT NORTHERN T. & S. CO.	Billings, Kevin & Cut Bank, Mont., Casper, Wyo.
GROSS SUPPLY CO.	El Dorado, Kansas
DRILLING & MINING EQUIPMENT CO.	Los Angeles 21, Calif.
OLYMPIC SUPPLY CO.	Seattle, Wash.
TURNER VALLEY SUPPLY CO., LTD.	Calgary, Alta.
DRILLERS SUPPLY CO.	Joplin, Mo.



32S47

Formations: Yates 2805 to 2847 ft, averaging 16 ft of oolitic lime pay. **Producing Area:** 80 acres. **Production June 30, 1947:** Daily: 67 bbls. Cumulative: 159,625 bbls. Estimated remaining reserves: 480,000 bbls. **Producing Wells June 30, 1947:** 2 flowing. **Gravity:** 20.8. **Rigs Running June 30, 1947:** None. **Deepest Test:** Darby Pet.'s University 3, C SW SW Sect 19, Blk 16, failure at 2952 ft. **Oil Outlets:** Stanolind. **Principal Leaseholders:** Sunray, Stanolind. **Remarks:** Dry holes define producing area.

QUITO
(GAS)

Discovery Data: Geology. **Discovery Well:** Kenneth Slack, Merry Bros. & Perini's Hayes 1, 330 ft out of n cor H&TC Ry 148, Blk 34, May 30, 1940. **Type of Structure:** Anticline. **Producing Formations:** Delaware at 5041 to 5088 ft, involving 47 ft of sand. **Producing Area:** 40 acres. **Producing Wells June 30, 1947:** 1 gas. **Rigs Running June 30, 1947:** None. **Deepest Test:** Roeser-Pendleton-Merry Bros. & Perini's Hayes 1, north offset to discovery, failure at 5397 ft. **Remarks:** Further development improbable.

SCOTT

Discovery Data: Geophysics. **Discovery Well:** Continental's F. H. Scott 1, 330 ft out of s cor H&TC Ry 33, Blk 33, completed November 15, 1946. **Type of Structure:** Anticline. **Producing Formations:** Delaware sd at 4850-4910 ft, 60 ft broken pay. **Producing Area:** 40 acres. **Production June 30, 1947:** Daily: 3 bbls. Cumulative: 1728 bbls. Estimated remaining reserves: Unimportant. **Producing Wells June 30, 1947:** 1 flowing. **Gravity:** 40. **Rigs Running June 30, 1947:** None. **Deepest Test:** Discovery drilled to 4920 ft, where partially junked. **Oil Outlets:** Trucks. **Principal Leaseholders:** Continental. **Remarks:** Discovery is 8½ mi sw nearest production (Delaware gasser). Flows by heads with output undiminished. More development due.

SEALY YATES SOUTH

Discovery Data: Geology. **Discovery Well:** Stanolind's University 2-Y, C SW NW Sect. 13, Blk 16, September 23, 1946. **Type of Structure:** Reef. **Producing Formations:** Yates 2681-2810 ft, averaging 79 ft of broken sand pay. **Producing Area:** 200 acres. **Production June 30, 1947:** Daily: 138 bbls. Cumulative: 23,783 bbls. Estimated remaining reserves: 500,000 bbls. **Producing Wells June 30, 1947:** 5 (flowing: 4; artificial lift: 1). **Gravity:** 28-30. **Rigs Running June 30, 1947:** None. **Deepest Test:** Stanolind's University 1-Y, C NE NW Sect 13, Blk 16, failure in Yates at 2917 ft. **Oil Outlets:** Atlantic. **Principal Leaseholders:** Stanolind. **Remarks:** Involves narrow field between the Pyote and Magnolia-Sealy South areas. More development to north and possibly paralleling the latter. Wider spacing than normally employed in Yates development.

IVERSON TOOL COMPANY

can supply your requirements for—

- **DRILLING**
- **PRODUCTION**
- **REFINING**
- **PIPE LINE—**

Supplies

BRANCH STORES

SALEM, ILL. — ARTESIA, N. M. — OKMULGEE, OKLA. — OKLAHOMA CITY, OKLA. — KERMIT, TEXAS — ODESSA, TEXAS

General Office — 216 West Second Street, Tulsa, Okla.

Phone 4-9127; L.D. 647

District Office — 632 Fort Worth Club Bldg., Fort Worth, Texas

SHIPLEY

Discovery Data: Random Drilling. **Discovery Well:** Shipley Oil's S. F. Hayzlett 1, 150 ft out of n cor of S¼ H&TC 17, Blk 5, November 2, 1928. **Type of Structure:** Anticline. **Producing Formations:** Seven Rivers 2390 to 2700 ft, averaging 91 ft of broken pay penetration. Queen 2770 to 3070 ft, averaging 101 ft of broken pay penetration. **Producing Area:** 2800 acres. **Production June 30, 1947:** Daily: 1236 bbls. Cumulative 7,586,490 bbls. Estimated remaining reserves: 13,414,000 bbls. **Producing Wells June 30, 1947:** Total: 144 (flowing, 16; pumping, 128). **Gravity:** 35-36. **Rigs Running June 30, 1947:** 3. **Deepest Test:** Gulf's Wristen Bros. 5, 330 ft out of e cor of W¼ H&TC Ry 18, Blk 5, which developed junked hole in Ellenburger at 9002-9187 ft. **Oil Outlets:** Atlantic. **Principal Leaseholders:** Atlantic, Duffey Oil Co., Leidecker & Vaughn; Mid-States Oil Corp.; Shell, Sinclair Prairie, James H. Snowden et al, Stanolind, Tide Water, Gulf. **Remarks:** Upper zone still capable of natural flow by majority of new completions. Considerable development possible in upper zone and in east portion of field.

SHIPLEY SILURIAN

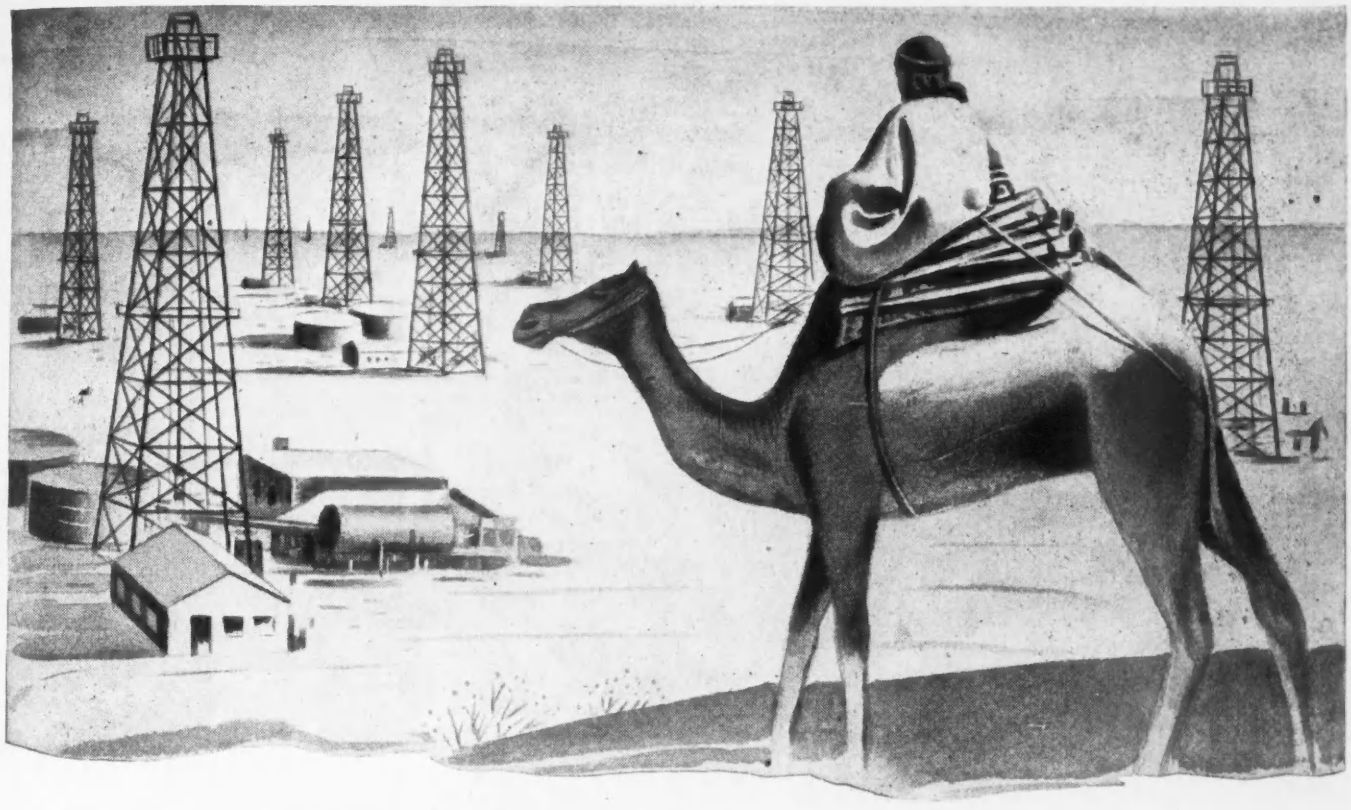
Discovery Data: Geophysics. **Discovery Well:** Gulf's Wristen Bros. 5, 330 out of e cor of W¼ H&TC Ry 18, Blk 5, completed December 11, 1940. **Type of Structure:** Anticline. **Producing Formations:** Silurian 7010 to 7062 ft, averaging 45 ft of lime pay. **Producing Area:** Developed: 80 acres. **Production June 30, 1947:** Daily: 49 bbls. Cumulative 76,981 bbls. Estimated remaining reserves: 403,000 bbls. **Producing Wells June 30, 1947:** 2 flowing. **Gravity:** 32.2-33.7. **Rigs Running June 30, 1947:** 1. **Deepest Test:** Discovery developed junked hole in Ellenburger at 9002-9187 feet and plugged back. **Oil Outlets:** Trucks to Gulf's pump station for blending with other crude due to high viscosity of Silurian oil. **Principal Leaseholders:** Gulf. **Remarks:** Production flow penalized due to excessive gas-oil ratio. Area is an outstanding Ellenburger prospect as discovery recovered oil-saturated dolomite from Ellenburger at 9002-9187 feet, then junked lower section of hole without decisive drill-stem test of Ellenburger. Discovery is first Silurian producer for state.

SPENCER

Discovery Data: Geology geophysics. **Discovery Well:** Stanolind's Spencer-Evans 1, 467 ft out of n cor W¼ H&TC 53, Blk 34, June 27, 1941, field discovery in Seven Rivers zone. Stanolind's Monroe 1, 660 ft from nw, 1992 ft from sw l H&TC 52, Blk 34, completed June 21, 1943, Yates-zone discovery. **Type of Structure:** Reef. **Producing Formations:** Seven Rivers 2896 to 2952 ft; 12 wells, averaging 11 ft of pay. Yates 2697 to 2796 ft; 3 wells, averaging 62 ft of broken sand pay. **Producing Area:** Seven Rivers, 480 acres; Yates, 120 acres. **Production June 30, 1947:** Daily: 212 bbls (both zones). Cumulative: 359,157 bbls (both zones). Estimated remaining reserves: 3,241,000 bbls (both zones). **Producing Wells June 30, 1947:** Seven Rivers, Total 12 (flowing, 6, pumping 6). Yates, 3 pumping. **Gravity:** Seven Rivers 27-29; Yates 30-34.5. **Rigs Running June 30, 1947:** None. **Deepest Test:** Stanolind's Spencer 1-C, C N¼ of E¼ H&TC Ry 53, Blk 34, failure at 3000 ft. **Oil Outlets:** Stanolind. **Principal Leaseholders:** J. W. Murchison, Stanolind, Texas Co. **Remarks:** Minor extensions possible to west and southeast.

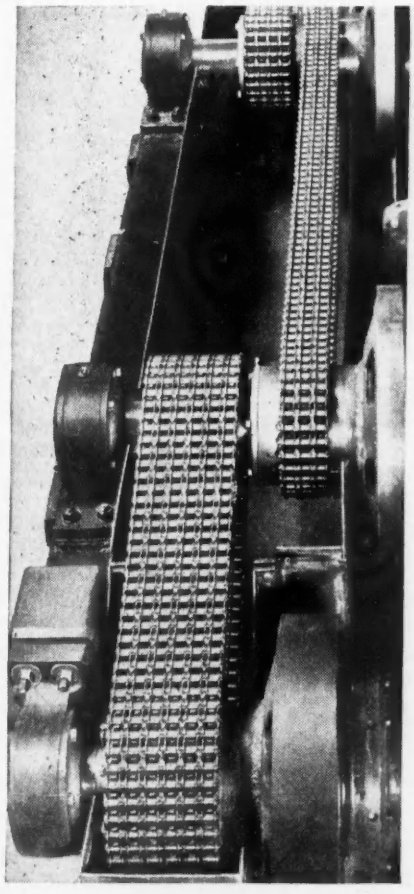
WARD, SOUTH

Discovery Data: Geology. **Discovery Wells:** Penn Oil-Atlantic's Bennett-Pure 1, 330 ft, out of n corner of s¼ H&TC 16, Blk 34, completed October 2, 1929, as discovery of Bennett sector. Alpine Oil & Development's Boogher (townsite) 1, 2456 ft from nw and 854 ft from m/w/sw lines H&TC 11, Blk 5, completed October 14, 1929, as discovery of Grand Falls townsite sector. F. H. Walsh (was J. G. Kugle's) Wallis 1, 330 ft from se and 1263 ft from sw lines H&TC 19, Blk 34, completed February 12, 1931, as discovery of Kugle area. **Type of Structure:** Anticline. **Producing Formations:** Yates and Seven Rivers: Bennett 2123-2630 ft; Grand Falls townsite 2150-2500 ft; Kugle 2400-2680 ft. **Producing Area:** 10,000 acres (scattered). **Production June 30, 1947:** Daily: 1345 bbls. Cumulative: 30,320,000 bbls. Estimated remaining reserves: 2,400,000 bbls. **Producing Wells June 30, 1947:** Total: 525 (flowing, 48; artificial lift, 460; dormant, 17). **Gravity:** 32-36. **Rigs Running June 30, 1947:** None. **Deepest Test:** Standard's Durgin 1-X, c n¼



Dependability of Diamond Drives is Essential to Successful Operation of

OIL FIELD MACHINERY IN DISTANT LANDS

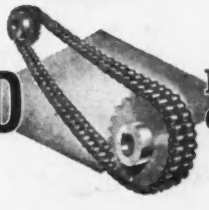


The unmatched serviceability record of Diamond Roller Chain Drives on leading makes of oil field machinery in domestic and foreign use during the last quarter-century is your best assurance that Diamond Drives will continue to be a wise choice for the equipment you make or purchase.

Proved dependability of performance—proved ability "to take it" —requisite for every element of production machinery "stateside," is even more vital, if possible, in foreign fields, where handicaps of usage and maintenance are most severe and where the consequences of mechanical troubles impose extreme penalties of delay and lost production.

In locations far removed from field stores, warehouses and specialized services—and from quick transportation—whether in the East Indies or Saudi Arabia—Latin America or Egypt—Iraq or Iran—your investments in Diamond Roller Chain Drives will *pay out.*

Practical recommendations are always available to you when considering model changes or new equipment. DIAMOND CHAIN COMPANY, Inc., Dept. 485, 402 Kentucky Avenue, Indianapolis 7, Indiana. *Tulsa Office:* 2238 Terwilleger Blvd.



DIAMOND ROLLER CHAINS

of 8¼ H&TC 15, Blk 34, failure in lime and chert at 10,009 ft, topped Mississippi at 9272 ft. **Oil Outlets:** Atlantic, Wickett, Pasotex. **Principal Leaseholders:** Amerada, Atlantic, D. H. Bolin, Bond Oil, M. C. Burnett Trust, Cities Service, Eastland, D. D. Feldman, Grisham Hunter, Chas. F. Kolp, Reno Oil, Richardson Oil, Sinclair, Standard, Stanolind, Sunray, Texas Pacific, Stanley A. Thompson, F. H. Walsh, Westbrook & Cayton. **Remarks:** About 200 wells have been depleted and plugged. Future development will be negligible unless deeper oil zones are uncovered. All but six wells produce less than ten barrels daily and wholesale plugging of non-profitable wells is inevitable.

WILSON

Discovery Data: Random Drilling. **Discovery Well:** C. H. Mahres, Kenneth Slack et al's Pat Wilson 1, 330 ft from swl 1650 ft from sel H&TC 133, Blk 34, completed August 19, 1937. **Type of Structure:** Anticline. **Producing Formations:** Delaware 5023 to 5087 ft, averaging 16 ft broken sand pay. **Producing Area:** 80 acres. **Production June 30, 1947:** None. Cumulative: Nominal production mostly used locally for fuel. Estimated remaining reserves: Depleted. **Gravity:** 38-39. **Rigs Running June 30, 1947:** None. **Deepest Test:** Discovery deepened to 5120 ft; plugged October 15, 1938. **Oil Outlets:** None. **Remarks:** Discovery registered initial flow of 133 bbls oil, but dropped sharply. Second oil producer, mile northwest, flowed briefly at rate of 24 bbls daily, but depleted within several months.

WARD-WINKLER

MONAHANS CLEAR FORK AND PERMIAN

Discovery Data: Geology. **Discovery Well:** Shell's Sealy-Smith 2, SE SW NE G&MMB&A 38, Blk A, completed November 11, 1942, discovery of Clear Fork (Tubb) zone. Shell's Sealy-Smith 6, C NW SE G&MMB&A 37, Blk A, completed August 11, 1945, discovery of Upper Clear Fork zone. **Type of Structure:** Anticline. **Producing Formations:** Monahans "Permian": Lower Clear Fork 5633-5643 ft; 1 well, with 10 ft perf zone. Monahans "Clear Fork": Upper Clear Fork 4685 to 5025 ft; 13 wells, averaging 242 ft of broken lime pay. **Producing Area:** Monahans "Permian" developed: 40 acres. Monahans "Clear Fork" developed: 520 acres. **Production June 30, 1947:** Daily: Monahans "Permian" 153 bbls (1 well). Monahans "Clear Fork" 1362 bbls (13 wells, base allowable). Cumulative: Monahans "Permian" 67,827 bbls. Monahans "Clear Fork" 280,451 bbls. Estimated remaining reserves: Monahans "Permian" 252,000 bbls. Monahans "Clear Fork" 3,880,000 bbls. **Producing Wells June 30, 1947:** 14 flowing. **Gravity:** Monahans "Permian" 34.5; Monahans "Clear Fork" 36-38.9. **Rigs Running June 30, 1947:** 3. **Deepest Test:** Discussed under Monahans "Ellenburger." **Oil Outlets:** Shell. **Principal Leaseholders:** Shell controls with 19,725-acre lease. **Remarks:** Productive area of both zones undefined, except for 5008-ft failure on northeast edge; to be expanded into substantial crude reserve; development of 5600 ft zone to be held in abeyance.

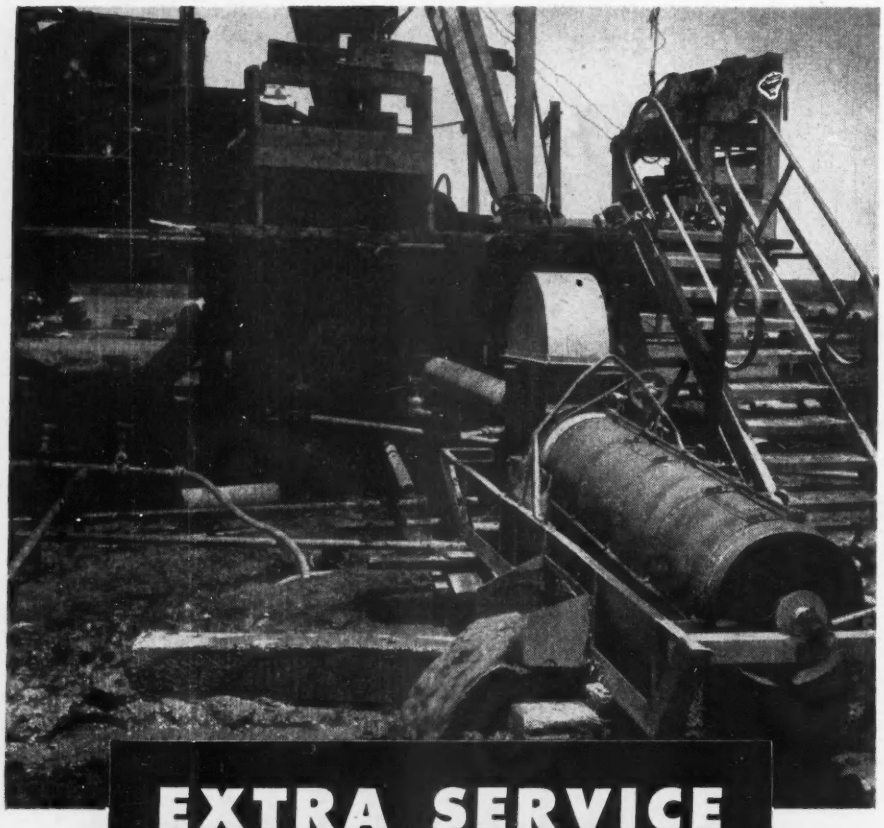
WARD-NORTH ESTES

Discovery Data: Geology. **Discovery Well:** Sinclair Prairie's (was Prairie O&G Co.) Sealy 1, C SW GMMB&A 95, Blk A, completed February 2, 1929, as gasser. Gulf's G. W. O'Brien et al 4, C NW SW GMMB&A 19, Blk F, completed April 12, 1929, as oil discovery for Gulf-O'Brien sector. Humble's Richter 1, 1650 ft from nel 990 ft from sel H&TC 27, Blk 34, completed July 1, 1933 as discovery of Estes sector and in upper pay. Tide Water (was Simms Oil) Johnson 1, 330 ft out of e cor H&TC 28, Blk 34, completed June 23, 1934, lower-pay discovery. **Type of Structure:** Anticline. **Producing Formations:** Yates 2410-2700 ft, average 159 ft penetration (Estes sector). Seven Rivers 2780-2950 ft, average 87 ft penetration (Estes sector). Seven Rivers 2425-2800 ft, average 193 ft penetration (north area). **Producing Area:** 8800 acres (assigned); 13,800 acres (scattered). **Production June 30, 1947:** Daily: 9912 bbls. Cumulative: 58,469,600 bbls. Estimated remaining reserves: 51,930,000 bbls. **Producing Wells June 30, 1947:** Total: 888 (flowing: 373; pumping: 515). **Gravity:** 32-35. **Rigs Running June 30, 1947:** 4. **Deepest Test:** Gulf's Hutchings 184, SW NE GMMB&A 10, Blk N, failure at 3819 ft; pb to oil pay. **Oil Outlets:** Atlantic, Gulf, Wickett P. L. Co. **Principal Leaseholders:** Atlantic, Cities Service, Eastland Oil Co., Gulf, Humble, Magnolia, Richardson Oils, S. W. Richardson, Skelly, Standard of Texas, Stanolind, Sun, Texas Co., Tide Water, F. H. Walsh, West Texas O&Roy. Corp. **Remarks:** Developed on 10-acre spacing, except for 16 wells on 5 acre pattern. Field extends north-south 18½ miles, joining Halley field on north. Gulf has conducted continuous development since its discovery of north portion, and has scores of proved locations that will be drilled on both sides of the field. North Ward and Estes fields consolidated November 8, 1944, for proration rules.

WINKLER-ECTOR

WHEELER

Discovery Data: Geophysics. **Discovery Well:** Stanolind-Shell's W. D. Blue 1, SE NW NW T&P Ry 15, Blk 46, T-1-S, completed June 17, 1943, Ellenburger pay discovery. Sun's Wheeler 1, C NE SE PSL 13, Blk B-7, completed March 22, 1945, Devonian pay discovery, first dual completion. Stanolind-Shell's Waddell Bros. 1, C SE SE PSL 8, Blk B-7, completed December 5, 1945, discovery for Silurian pay. **Type of Structure:** Anticline. **Producing Formations:** Ellenburger 10,523 to 10,710 ft; 27 wells, averaging 46 ft of exposed pay. Devonian 8360 to 8658 feet; 25 wells, averaging 113 ft of exposed pay. Silurian 9270 to 9390 ft; 1 well, involving 120 ft of lime pay. **Producing Area:** Ellenburger: 2160 acres. Devonian: 2000 acres. Silurian: 80 acres. **Production June 30, 1947:** Daily: Ellenburger 3989 bbls; Devonian 1762 bbls; Silurian 24 bbls. Cumulative: Ellenburger 2,502,396 bbls; Devonian 657,243 bbls; Silurian 18,234 bbls. Estimated remaining reserves: Ellenburger 40,689,000 bbls; Devonian 19,343,000 bbls; Silurian, not important. **Producing Wells June 30, 1947:** Ellenburger 27 flowing; Devonian 25 flowing; Silurian 1 pumping. **Gravity:** Ellenburger 44.2-46.3; Devonian 34-49; Silurian 31. **Rigs Running June 30, 1947:** 6. **Deepest Test:** Stanolind-Shell's Waddell Bros. 1, Silurian pay discovery plugged back from barren Ellenburger 10,740-10,813 ft. **Oil Outlets:** Shell, Humble, Stanolind connection pending. **Principal Leaseholders:** Cities Service, Mid-Continent, Phillips, Samedan Oil Corp., Stanolind-Shell, Sun, Sunray, Superior, Texas Co., Tide Water. **Remarks:** Majority of wells dually completed in Devonian and Ellenburger; 80-acre spacing observed for each zone, but Devonian likely to be drilled up to 40-acre pattern. Silurian not an important source of production. Productive area will be expanded west and especially to south.



EXTRA SERVICE

The separator means that the drilling contractor gets extra service from his drilling mud. The experienced staff of Republic's Oil Department means that you get extra service in the handling of your financing needs. With a background of petroleum and skilled in finance, the men of the Republic Oil Department offer complete and sympathetic understanding of your problems. Come in and discuss your requirements at any time.

REPUBLIC

NATIONAL BANK OF DALLAS

Capital and Surplus $20,000,000 Member Federal Deposit Insurance Corp. Largest in the South

but keeps your engine free from sludge!

Kids play a harmless game with *static electricity*. When the weather is just right, they can shuffle around on a rug and produce a tickling "shock" by touching one another or any metal object.

Yet, this same phenomenal force of *static electricity* . . . which furnishes amusement to a gang of kids . . . can go seriously to work for you inside your high-speed diesel and heavy-duty gasoline engines . . . from the moment you start using Conoco HD Oil. For Conoco HD contains a special ingredient that charges solid particles in oil *electrostatically*, forces them to stay apart . . . stops them . . .

. . . from forming muck in the pan!
. . . from gumming up in ring grooves!
. . . from clogging up oil screens!

Extra benefits are Conoco HD's heat-resistance and ability to inhibit engine corrosion and oxidation! To get Conoco HD oil *fast*, phone to nearest office of Continental Oil Company.

CONOCO HEAVY-DUTY OIL

CONOCO HD

WINKLER

EAVES

Discovery Data: Geology. **Discovery Well:** Bert Fields et al's Daugherty-Wentz 1, 330 ft ewl and 2970 ft nsl PSL 3, Blk C-23, completed November, 1936. **Type of Structure:** Reef. **Producing Formations:** Yates and Seven Rivers 2998 to 3205 ft, averaging 49 ft of broken sandy-lime pay. **Producing Area:** 520 acres. **Production June 30, 1947:** Daily: 1110 bbls. Cumulative: 2,790,715 bbls. Estimated remaining reserves: 1,860,000 bbls. **Producing Wells June 30, 1947:** Total 25 (flowing, 1; artificial lift, 24). **Gravity:** 28-30. **Rigs Running June 30, 1947:** None. **Deepest Test:** Ralph Lowe's Edward's-Gulf 1, NE NE SW PSL 5, Blk C-23, failure in San Andres at 3636 ft. **Oil Outlets:** Stanolind. **Principal Leaseholders:** Bert Field, G. E. Hall, E. C. Hitchcock & Sons, Sun. **Remarks:** Producing area links with Leck field to south and Eaves field (N. M.) to north, and is virtually defined. Wells yielding large volume of water.

EMPEROR

Discovery Data: Geology and trend drilling. **Discovery Well:** Emperor Oil Co.'s Halley 1, October 3, 1935. **Type of Structure:** Anticline. **Producing Formations:** Yates 2700-3070 ft, averaging 157 ft of penetration. **Producing Area:** 1675 acres. **Production June 30, 1947:** Daily: 1276 bbls. Cumulative: 4,865,376 bbls. Estimated remaining reserves: 3,247,000 bbls. **Producing Wells June 30, 1947:** 84 (flowing 60; artificial lift: 24). Depleted: 9. **Gravity:** 32-34. **Rigs Running June 30, 1947:** None. **Deepest Test:** Skelly's Halley 26, SE NW NW PSL 6, Blk B-11, drilled through pay to 3145 ft. **Oil Outlets:** Magnolia, Shell. **Principal Leaseholders:** Champlin, M. E. Daniel, Emperor, F. W. Estill, Phillips, Skelly, T. P. Coal & Oil, Roy A. Westbrook. **Remarks:** Adjoins Halley field on north. More development pending on east, west and north, as productive limits only partially defined and outside wells among largest producers at present.

EMPEROR DEEP

Discovery Data: Geology and trend drilling. **Discovery Well:** Bert Fields et al's Cowden-Pure 1, NW NW SE PSL 26, Blk B-5, September 23, 1936. **Type of Structure:** Anticline. **Producing Formations:** Seven Rivers 2740-3070 ft, averaging 159 ft of penetration, with average of 40 ft of effective pay. **Producing Area:** 800 acres. **Production June 30, 1947:** Daily: 190 bbls. Cumulative: 1,259,200 bbls. Estimated remaining reserves: 350,000 bbls. **Producing Wells June 30, 1947:** 37 (flowing: 8; artificial lift: 29). Depleted or converted to gas: 13. **Gravity:** 29-32. **Rigs Running June 30, 1947:** None. **Deepest Test:** See Emperor-Holt field. **Oil Outlets:** Magnolia, Shell. **Principal Leaseholders:** Bates-Reading Oil Corp., Champlin Ref., Bert Fields, C. V. Lyman, Stanolind, Texon. **Remarks:** About half of field developed on 10-acre spacing, and all such wells have declined to 7 barrels and less daily. Further development will be for shallow gas, and the Glorietta (Holt) zone, which is discussed under separate heading.

EMPEROR HOLT

Discovery Data: Geology. **Discovery Well:** T. P. Coal & Oil's Brown-Altman 1, Lse 4, C SW SW PSL 25, Blk B-5, completed March 12, 1946. **Type of Structure:** Anticline. **Producing Formations:** Glorietta (Holt) oil: 4765 to 4817 ft; 5 wells, averaging 26 ft lime pay. Glorietta (Holt) gas: 4810 to 4823 ft; 1 well, involving 13 ft of pay. **Producing Area:** 200 acres (oil); 40 acres (gas). **Production June 30, 1947:** Daily. 297 bbls. Cumulative: 85,285 bbls. Estimated remaining reserves: 1,115,000 bbls. **Producing Wells June 30, 1947:** 5 flowing. **Gravity:** 37-40.6. **Rigs Running June 30, 1947:** None. **Deepest Test:** Discovery plugged back from 6255 ft in Clear Fork. **Oil Outlets:** Shell, Magnolia. **Principal Leaseholders:** N. G. Penrose, Phillips, Stanolind, T. P. Coal & Oil. **Remarks:** Extensions will occur on north-south trend. Other local highs in general area due to produce from this zone.

HALLEY

Discovery Data: Geology and trend. **Discovery Well:** Skelly's Halley 1, 2200 ft out of NEc PSL 25, Blk B-11, completed August 27, 1934, oil discovery; ditto's Halley 2, 1320 ft snl and 2200 ft wel PSL 25, Blk B-11, completed September 24, 1935, gas discovery. Richardson Oils Hill 1, SW SW SE PSL 18, Blk B-11, completed February 23, 1935, discovery for Hill sector. **Type of Structure:** Anticline. **Producing Formations:** Yates and Seven Rivers 2684-3150 ft, averaging 127 ft of broken pay. **Producing Area:** Developed: 1000 acres, with 360 acres of undrilled inside area. **Production June 30, 1947:** Daily: 766 bbls. Cumulative: 1,807,649 bbls. Estimated remaining reserves: 2,192,000 bbls. (developed). **Producing Wells June 30, 1947:** 51 (flowing: 24; artificial lift: 27). **Gravity:** 31-34. **Deepest Test:** Skelly's Halley 3, 2200 ft snl and 1320 ft wel PSL 25, Blk B-11, failure in San Andres at 3855 ft; pb to regular pay as gasser. **Oil Outlets:** Shell. **Principal Leaseholders:** W. A. Black & Sons, East land Oil, F. W. Estill, Skelly, Richardson Oils, Sun Stanolind, Sunray. **Remarks:** Embraces 2-mile interval and links with North Ward-Estes on south and Emperor field on north, but includes the Hill 8-well sector situated 2 miles east. East side of Halley field proper will receive more development.

HENDERSON

Discovery Data: Geology and trend drilling. **Discovery Well:** W. K. Roy, Co.'s (was Uscan Oil Co., previously R. H. Henderson et al) J. B. Walton-Humble 1-A, NE NE NE PSL 9, Blk B-26, April 6, 1936. **Type of Structure:** Reef. **Producing Formations:** Yates and Seven Rivers: 2840 to 3127 ft, averaging 59 ft of effective pay. **Producing Area:** 1400 acres. **Production June 30, 1947:** Daily 1582 bbls. Cumulative 11,945,576 bbls. Estimated remaining reserves: 4,854,000 bbls. **Producing Wells June 30, 1947:** Total 81 (flowing, 42; artificial lift, 39; depleted, 59 wells). **Gravity:** 29-31. **Rigs Running June 30, 1947:** None. **Deepest Test:** Shell's Leck 1, NE NE SE PSL 32, Blk 74, failure at 3450 ft. **Oil Outlets:** Stanolind, Atlantic. **Principal Leaseholders:** Atlantic, Humble, R. Olsen Oil Co., Sinclair Prairie, Skelly. **Remarks:** The most prolific section of the producing stratum of this field is close to the water table. Developed on 10-acre pattern. Production could be linked with Leck to north and Hendrick to south.

HENDRICK

Discovery Data: Random drilling. **Discovery Well:** Stanolind-Westbrook-Thompson Holding Corp's (was R. A. Westbrook & Co.) T. G. Hendrick 1-A-T-67, 390 ft from el 340 ft from sl PSL 42, Blk B-5, (first oil flow July 17, 1926) completed September 7, 1926. **Type of Structure:** Reef. **Producing Formations:** Yates and Seven Rivers 2500-3200 ft, averaging 78 ft of pay. **Producing Area:** 9800 acres. **Production June 30, 1947:** Daily: 3425 bbls. Cumulative: 215,221,243 bbls. Estimated remaining reserves: 43,044,000 bbls. **Producing Wells June, 30, 1947:** 236: (flowing: 30; artificial lift: 206). Depleted, converted to gas or dormant: 416. **Gravity:** 27-30. **Rigs Running June 30, 1947:** 1. **Deepest Test:** Stanolind-Westbrook-Thompson's Hendrick 35-A-T-88-M, 710 ft nsl and 1980 ft wel, PSL 33, Blk 26, failure in Ellenburger 13,385-815 ft. **Oil Outlets:** Shell, Humble, Pasotex, Stanolind, Gulf. **Principal Leaseholders:** Atlantic, American Republic, Bates Reading, Continental, Eastland Oil, General Crude, Gulf, Humble, Murko Oil Roy., Shell, Sinclair Prairie, Skelly, Stanolind, Texas Co. **Remarks:** Development of regular pay about concluded. Remaining wells produce unusually large volume of water, which is a factor in prolonging the life of the field; field-wide lifting costs average about 36c per barrel. Approaching depletion of overlying dry gas zone causing operators to install compressing plants to continue gas-lift operations.

KERMIT

Discovery Data: Random drilling. **Discovery Wells:** T. J. Jeffries & J. C. Maxwell's (was V. T. Bolin) Brown-Altman 1, SE SE NW PSL 4, Blk B-3, completed July 19, 1928, discovery of Bolin sector. Reno Oil Co.'s (was Sayre Oil Co.) Howe 1, NW NW SW PSL 12, Blk 26, completed October 10, 1934, discovery of Sayre area. J. O. Fox-W. E. Butler & T. J. Jeffries' Brown-Altman 1, NE NE SW PSL 6, Blk B-5, completed March 9, 1935, discovery of Brown-Altman sector. Monday Oil Co.-Bert Fields' (was Wilson Keyes & A. W. Cherry) Central State Bank-Conoco 1, NW NW NE PSL 25, Blk 26, completed March 8, 1936, discovery of the Keyes area. **Type of Structure:** Anticline. **Producing Formations:** Yates 2700-3210 ft, with wide range of sandy-lime pay thickness. **Producing Area:** 13,600 acres (some scattered). **Production June 30, 1947:** Daily: 2241 bbls. Cumulative: 35,538,448 bbls. Estimated remaining reserves: 6,800,000 bbls. **Producing Wells June 30, 1947:** 643. (flowing: 70; artificial lift: 573). Depleted or converted to gas: 267. **Gravity:** 34 to 40. **Rigs Running June 30, 1947:** 1. **Deepest Test:** See Kermit Ellenburger. **Oil Outlets:** Gulf, Humble, Magnolia, Shell, Texas-New Mexico. **Principal Leaseholders:** Amerada, Joe Asbury, Atlantic, Bates-Reading, D. H. Bolin, S. Caprito, Conoco, Eastland, Emperor, Fox-Butler, Joe H. Goodman, W. A. Gourley, Gulf, G. E. Hall, Humble, Magnolia, J. C. Maxwell, Mid-Continent, Monday, Shell, Sinclair Prairie, Skelly, Stanolind, Sun, T. P. Coal, Texon, Tide Water, Westbrook Oil. **Remarks:** Only ½ of 1 percent of wells capable of making 10 barrels or more daily. These stripper wells have levelled off in recent years, and their combined output justifies their operation. Numerous wells operated on gas lift. Majority of field drilled on 10-acre pattern, and developed during restricted market demand, thus resulting in widespread

BURCH AGATE TORPEDO

"The Marble Shot"

THE TOOL THAT REMOVES ALL PRODUCTION BARRIERS IN OIL AND GAS WELLS

When it is well conditioning you need, the Burch Agate Torpedo assures capacity production at a new low over-all cost. Experience in 3000 wells treated to date is proof of the success you can expect when using explosive propelled marbles.

DISTRIBUTED AND SERVICED THROUGH ALL LICENSED SHOOTING COMPANIES

Manufactured by

BURCH AGATE TORPEDO

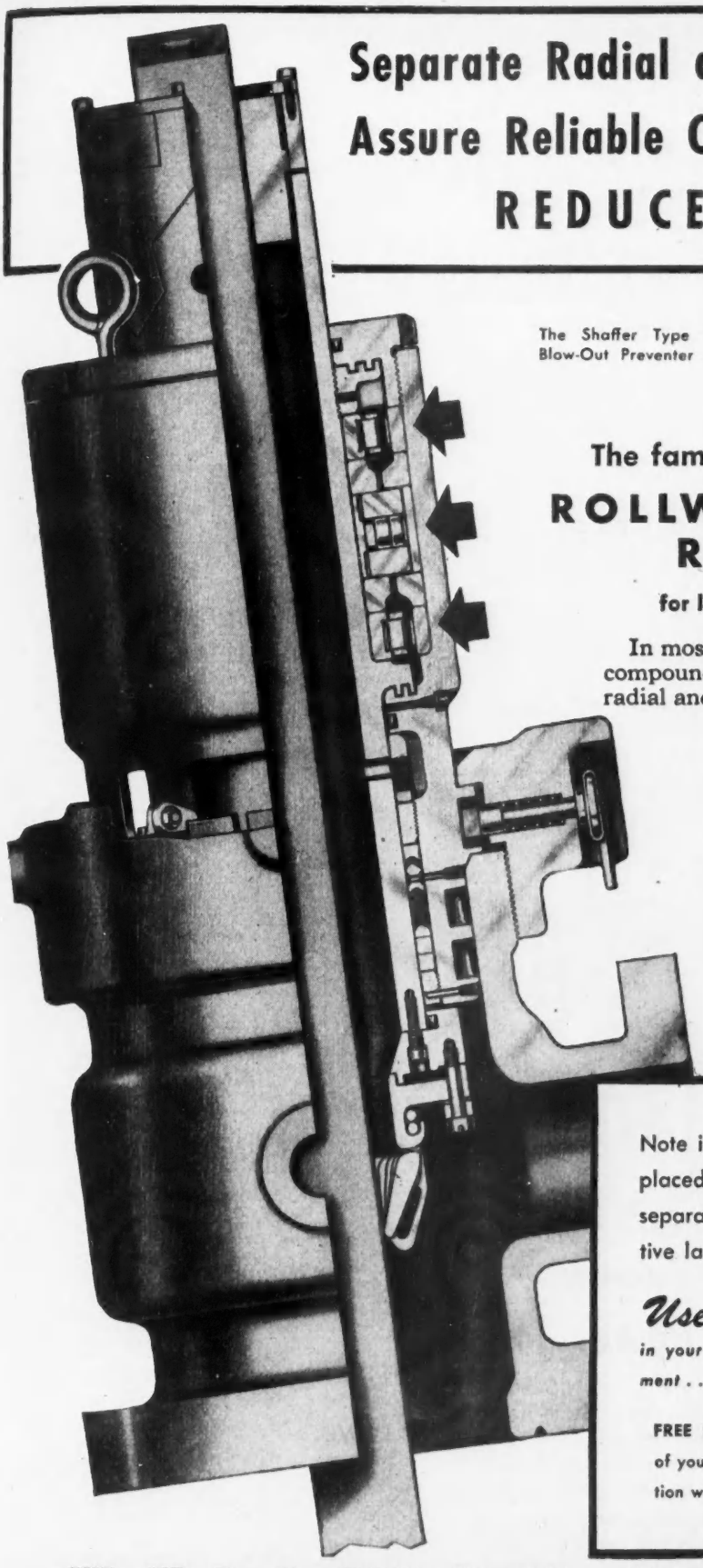
J. GORDON BURCH, Owner

Office – Black Hotel, Ph. 363 Shop – 602 Poplar Street

BORGER, TEXAS

Complete information upon request.

Separate Radial and Thrust Bearings Assure Reliable Operation . . . REDUCE MAINTENANCE !



The Shaffer Type 46 Combination Rotating Blow-Out Preventer and Stripper

The famous Shaffer Company depends on ROLLWAY *Right-Angle-Loaded* Roller Bearings

for longer service and better performance.

In most applications, Right-Angle Loading splits compound loads into the two components of pure radial and pure thrust, carrying each of these loads on separate bearing assemblies at a right angle to the rollers.

In the Shaffer Combination Rotating Blow-Out Preventer and Stripper, Rollway Roller Bearings which carry the radial loads are placed at a considerable distance apart so as to provide maximum resistance to wobble, lateral vibration and other off-center strains.

The thrust bearing takes tremendous pressure independently and is relieved of all lateral pressures which are taken by the radial bearings.

Note in the diagram how the thrust bearing is placed. Note also how the wide radial bearing separation gives maximum resistance to destructive lateral movement in the drill string.

***Use** Rollway Right-Angle-Loaded Roller Bearings in your machine for maximum strength . . . true alignment . . . and minimized maintenance shut-down.*

FREE SERVICE! Send us a print or detailed description of your bearing needs for FREE analysis. Your information will be held in strictest confidence.

ROLLWAY BEARINGS

ROLLWAY BEARING COMPANY, INC., SYRACUSE, N. Y.

SALES OFFICES: Philadelphia • Boston • Pittsburgh • Cleveland • Detroit • Chicago • Minneapolis • Houston • Los Angeles

dissipation of gas that was prime source of flowing energy. Deeper oil zones possible in some sectors, but such production will be confined to local highs.

KERMIT ELLENBURGER

Discovery Data: Geophysics. **Discovery Well:** Magnolia's J. B. Walton-State 20, C NW NW PSL 4, Blk B-3, completed May 18, 1943. **Type of Structure:** Anticline. **Producing Formations:** Ellenburger 10,635 to 10,705 ft, averaging 27 ft of dolomite pay. **Producing Area:** Developed: 160 acres. **Production June 30, 1947:** Daily: 285 bbls. Cumulative 352,388 bbls. Estimated remaining reserves: 640,000 bbls. **Producing Wells June 30, 1947:** 2 flowing. **Gravity:** 41.7-46.6. **Rigs Runnings June 30, 1947:** None. **Deepest Test:** Magnolia's Walton 234, C SE NE PSL 17, Blk 77, failure in Ellenburger at 10,708-10,896 ft, correlating 241 ft low to discovery. **Oil Outlets:** Magnolia. **Principal Leaseholders:** Magnolia controls. **Remarks:** Producers are ¾ mile plus apart; discovery makes top allowable. Additional development will be nominal.

KEYSTONE DEVONIAN

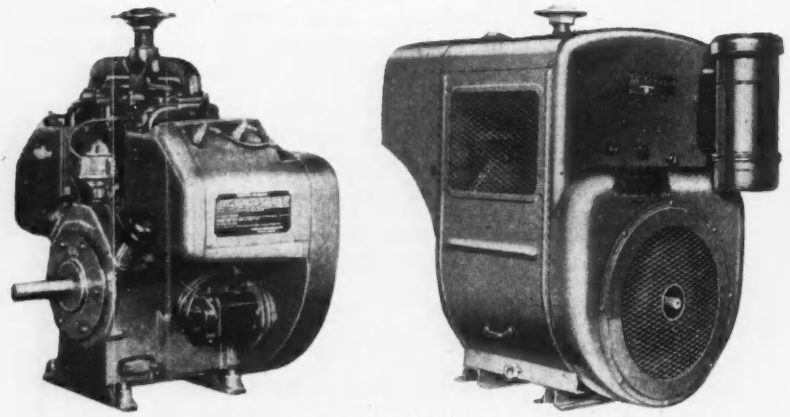
Discovery Data: Geology. **Discovery Well:** Stanolind's Mack Taylor 1, Tr. 2, C SW SW PSL 8, Blk B-2, completed April 6, 1946. **Type of Structure:** Anticline. **Producing Formations:** Devonian 7370 to 8191 ft, averaging 101 ft of cherty-lime pay. **Producing Area:** Developed: 800 acres; proved undrilled, 3600 acres plus. **Production June 30, 1947:** Daily: 2170 bbls. Cumulative: 351,599 bbls. Estimated remaining reserves: 6,048,000 bbls. **Producing Wells June 30, 1947:** 20 flowing. **Gravity:** 30.2-36.4. **Rigs Running June 30, 1947:** 3. **Deepest Test.** Discussed under Keystone-Ellenburger field. **Oil Outlets:** Gulf. **Principal Leaseholders:** Gulf, Phillips, Richards & Bass, Stanolind, Sun, John R. Sharp et al. **Remarks:** Pay zone varies throughout the field due to erosion within the section.

KEYSTONE ELLENBURGER

Discovery Data: Geophysics. **Discovery Well:** Amon G. Carter Foundation-Pure's (was Amon G. Carter and Pure) Walton 2-E, C SW NE PSL 1, Blk B-3, completed June 14, 1943. **Type of Structure:** Anticline. **Producing Formations:** Ellenburger 9548 to 10,092 ft, averaging 157 ft of exposed pay through open hole or perforations. **Producing Area:** Developed, 5840 acres. Proved undrilled, 600 acres. **Production June 30, 1947:** Daily: 27,062 bbls. Cumulative: 23,202,795 bbls. Estimated remaining reserves: 151,997,000 bbls (developed). **Producing Wells June 30, 1947:** 146 flowing. **Gravity:** 42-44.7. **Rigs Running June 30, 1947:** 11. **Deepest Test**: Continental's Walton 1-D, C SE SW PSL 20, Blk 77, west offset to Ellenburger production, encountered overturned fold, with top of barren Ellenburger at 10,180 ft, and failure in 2nd. Simpson at 10,756 ft; plugged back and produced briefly from Holt zone. **Oil Outlets:** Gulf, Humble. **Principal Leaseholders:** Amon G. Carter Foundation, Pure, General American, Gulf, Humble, Phillips, Sid W. Richardson, Richardson & Bass, John R. Sharp and R. C. Barnes, Sinclair Prairie, Stanolind. **Remarks:** Ellenburger pay has maximum thickness of 580 feet. Average crude yield per acre materially reduced within past 6 months due to heavy volume of completions near edge of structure with nominal pay thickness above the oil-water contact. Water injection program contemplated for east side of structure to retard rise of water table. Ellenburger oil affords exceptionally high grade of lube stock. Commercial oil production from Simpson indicated by some wells.

KEYSTONE HOLT

Discovery Data: Geology. **Discovery Well:** Richardson & Bass' Walton 4, 440 ft out of SWc PSL 5, Blk B-2, deepened Keystone-Lime well, completed September 11, 1943, Holt pay discovery. **Type of Structure:** Anticline. **Producing Formations:** Holt (Glorietta) 4683 to 4885 ft, averaging 34 feet of broken lime pay. **Producing Area:** Developed: 2560 acres. Proved undrilled: 1440 acres. **Production June 30, 1947:** Daily: 4630 bbls. Cumulative: 2,351,124 bbls. Estimated remaining reserves: 18,129,000 bbls (developed). **Producing Wells June 30, 1947:** Total: 64 (flowing: 61; artificial lift: 3). **Gravity:** 35-41.5. **Rigs Runnings June 30, 1947:** 2. **Deepest Test:** Discussed under Keystone Ellenburger. **Oil Outlets:** Gulf. **Principal Leaseholders:** Amon G. Carter Foundation, Pure, Gulf, Humble, Falcon Co., Phillips, Richardson & Bass, John R. Sharp-R. C. Barnes. **Remarks:** Long flowing life due to wide spacing and abundance of gas in the Glorietta sections. Underlying Clear Fork beds penetrated and found capable of flush production, but such wells plugged back to Glorietta to delay the launching of new wave of offset drilling until last half of year.



Let this 20-Horse Team

Handle Your Heavy-Duty Power Jobs

Turning up 20.5 hp. at 2200 R.P.M. the Model VE-4 WISCONSIN Standard Air-Cooled Engine (left) and the Model VE-4 Complete Power Unit (right), can always be depended upon for continuous, heavy-duty operation in any kind of service, on any kind of equipment within their power range.

Positive, trouble-free AIR-COOLING; dynamically balanced crankshaft mounted on tapered roller bearings, *front* and *rear*; extra-long connecting rods; light weight pistons . . . these are features that you can bank on for top performance.

Specify Wisconsin Air-Cooled Engines for YOUR equipment . . . for most hp.-hours of service, at the lowest overall cost.

WISCONSIN MOTOR Corporation
MILWAUKEE 14, WISCONSIN
World's Largest Builders of Heavy-Duty Air-Cooled Engines

WRITE TO HARLEY SALES CO.
510 Atlas Building, Tulsa, Oklahoma
M & M Building, Houston, Texas
Oil field distributors for Wisconsin Engines and all types of utility units.

KEYSTONE LIME AND COLBY SAND

Discovery Data: Geology and geophysics. **Discovery Well:** Gulf's Keystone 1, NE NE NW PSL 10, Blk B-3, completed July 10, 1935, first oil well on the structure, discovery for lime area. M. J. Bashara & Sons-Protho Co.'s Fee 2, NW SW SE PSL 17, Blk B-3, completed January 27, 1930, oil discovery of Bashara field, later merged with Keystone Colby field. **Type of Structure:** Anticline. **Producing Formations:** Keystone Lime (San Andres) 3145 to 3702 ft, averaging 193 ft of broken lime pay. Keystone Colby (Grayburg) 2913 to 3606 ft, averaging 138 ft broken lime pay. **Producing Area:** Keystone Lime 4000 acres (scattered). Keystone Colby 5700 acres (developed). **Production June 30, 1947:** Daily: Keystone Lime 850 bbls; Colby 3237 bbls. Cumulative: Keystone Lime 6,098,362 bbls; Colby 10,706,608 bbls. Estimated remaining reserves: Keystone Lime 5,902,000 bbls; Keystone Colby 23,493,000 bbls. **Producing Wells June 30, 1947:** Keystone Lime Total: 110 (flowing, 50; artificial lift, 60). Keystone Colby Total: 322 (flowing, 203; artificial lift 119). **Gravity:** Keystone Lime 35-37.8; Keystone Colby 33.7-39. **Deepest Test:** Keystone Ellenburger. **Oil Outlets:** Gulf. **Principal Leaseholders:** Bashara & Sons, Protho Co., R. G. Barnes, A. G. Carter, Pure, Falcon Co., Gulf, Phillips, Magnolia, Richardson & Bass, Sinclair Prairie, John R. Sharp et al, General American, Standard of Texas, Stanolind, Sun, Tide Water, Texas Co. **Remarks:** Lime zone has been disappointing in per acre yield; about 80 percent of the wells have declined to marginal basis. Close spacing adhered to in some sectors and 40 acres per well since it became apparent dense drilling not profitable. Colby zone developed on 10-acre pattern by 41 wells, remainder on 18.78-acre units; all wells on 10-acre spacing are marginal producers.

KEYSTONE SILURIAN

Discovery Data: Geology. **Discovery Well:** Sun's Keystone Cattle Co. 2, 660 ft nsl and 1987 ft wel PSL 4, Blk 44, completed June 2, 1945. **Type of Structure:** Anticline. **Producing Formations:** Silurian 8000 to 8594 ft, averaging 100 ft of lime pay. **Producing Area:** Developed: 520 acres. Proved undrilled: 3080 acres. **Production June 30, 1947:** Daily: 1352 bbls. Cumulative: 148,429 bbls. Estimated remaining reserves: 1,932,000 bbls (developed). **Producing Wells June 30, 1947:** 12 flowing; 1 depleted. **Gravity:** 31.9-39.5. **Rigs Running June 30, 1947:** 9. **Deepest Test:** See Keystone Ellenburger. **Oil Outlets:** Gulf, **Principal Leaseholders:** Gulf, Humble, Richardson & Bass, John R. Sharp & R. C. Barnes, Sun. **Remarks:** Silurian pay discovery on northwest edge pumped 9700 bbls oil prior to plugging back to more productive Devonian. Silurian affords lowest crude yield per acre of all zones on the structure, but owners will plug back to overlying Devonian when Silurian wells become non-profitable.

LECK

Discovery Data: Geology. **Discovery Well:** Atlantic's (was H. F. Gibson-Kirk Johnson et al) Lum Daugherty 1, C S½ N½ SW PSL 3, Blk 74, May 9, 1928. **Type of Structure:** Reef. **Producing Formations:** Yates and Seven Rivers 2941 to 3192 ft, averaging 68 ft of broken sandy-lime pay. **Producing Area:** 500 acres (scattered). **Production June 30, 1947:** Daily: 614 bbls. Cumulative: 2,109,671 bbls. Estimated remaining reserves: 703,000 bbls. **Producing Wells June 30, 1947:** Total: 16 (flowing, 3; artificial lift, 13; depleted, 8). **Gravity:** 28-30. **Rigs Running June 30, 1947:** None. **Deepest Test:** Empire's Daugherty 1-B, SW SE NE PSL 3, Blk 74, failure in San Andres at 3780 ft. **Oil Outlets:** Texas-New Mexico, Stanolind. **Principal Leaseholders:** Atlantic, Cities Service, Bert Fields, G. E. Hall, Hitchcock & Sons, Fred Hogan, Sinclair Prairie. **Remarks:** Production performance of this area proved to be erratic, with a few wells showing exceptionally high crude yield, which is attributed to water-drive. Linked with Eaves field to north and likely to continue south to Henderson field.

LOWE

Discovery Data: Geology. **Discovery Well:** Ralph Lowe et al's Sealy-Smith Foundation-Stanolind 1, C SW SW G&MMB&A 71, Blk A, completed September 5, 1946. **Type of Structure:** Anticline. **Producing Formations:** Upper Clear Fork li at 5220-80 ft. **Producing Area:** 40 acres. **Production June 30, 1947:** Cumulative: 1900 bbls. Estimated remaining reserves: Depleted. **Gravity:** 34-36. **Rigs Running June 30, 1947:** None. **Deepest Test:** Discovery plugged back from 6500 ft (Clear Fork). **Principal Leaseholders:** Lowe, Stanolind. **Remarks:** Depletion of the discovery and nearby failures discourage further development, although Lower Permian and Pre-Permian not explored.

MONAHANS GLORIETTA, NORTH

Discovery Data: Geology. **Discovery Well:** Stanolind's Sealy-Smith 8, C SW NW G&MMB&A 48, Blk A, completed August 11, 1946. **Type of Structure:** Anticline. **Producing For-**

Equipped with

heavy steam,
diesel, and
butane

Rotary Rigs

operating in
Texas, Louisiana
and Florida

Al Buchanan

DRILLING COMPANY

SUITE 2112-17 ALAMO NATIONAL BUILDING

SAN ANTONIO 5, TEXAS

Telephone: FANNIN 1271

Look Ahead With First National

We do not operate
a Night and Day Bank
BUT . . . .

1st *of Tulsa* **Oil Financing**

is at Work!

24 HOURS PER DAY

THE FIRST NATIONAL BANK
AND TRUST COMPANY OF TULSA

MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION

mations: Glorietta (Holt) 5115 to 5190 ft, averaging 60 ft of broken lime pay. **Producing Area:** Developed: 80 acres. **Production June 30, 1947:** Daily: 240 bbls. Cumulative: 56,905 bbls. Estimated remaining reserves: 503,000 bbls (developed). **Producing Wells June 30, 1947:** 2 flowing. **Gravity:** 35-36. **Rigs Running June 30, 1947:** None. **Deepest Test:** Stanolind's Sealy-Smith 9, west offset to discovery, plugged back from 5230 ft. **Oil Outlets:** Shell. **Principal Leaseholders:** Stanolind controls. **Remarks:** Both wells flow their top allowable; no failures in area; extent of productive area speculative.

MONAHANS NORTH

Discovery Data: Geology-geophysics. **Discovery Well:** Stanolind's Sealy-Smith 1, C SW SW G&MMB&A 50, Blk A, completed March 23, 1944. **Type of Structure:** Anticline. **Producing Formations:** Clear Fork (Tubb) 6095 to 6300 ft, averaging 97 ft of broken lime pay. **Producing Area:** Developed: 240 acres. **Production June 30, 1947:** Daily: 174 bbls. Cumulative: 177,828 bbls. Estimated remaining reserves: 964,000 bbls. **Producing Wells June 30, 1947:** Total: 6 flowing. **Gravity:** 34-37. **Rigs Running June 30, 1947:** None. **Deepest Test:** Stanolind's Sealy-Smith 16-A, mile west of production, failure at 6500 ft. **Oil Outlets:** Stanolind. **Principal Leaseholders:** Stanolind, Texas Co. **Remarks:** Mile interval, trending NW SE, undeveloped between 2 groups of wells. Southeast extension most probable.

SCARBOROUGH

Discovery Data: Subsurface geology. **Discovery Well:** Shell-Llano Oil's W. F. Scarborough 1, C PSL 1, Blk C-22, October 19, 1927. **Type of Structure:** Anticline. **Producing Formations:** Yates sandy-lime 2770-3335 ft, average 129 ft penetration. **Producing Area:** 1450 acres (developed); 1800 acres (scattered). **Production June 30, 1947:** Daily: 555 bbls. Cumulative: 6,834,752 bbls. Estimated remaining reserves: 1,140,000 bbls (developed). **Producing Wells June 30, 1947:** Total: 120 (flowing, 27; artificial lift, 93; depleted, 25). **Gravity:** 34-37. **Rigs Runnings June 30, 1947:** None. **Deepest Test:** Shell-Llano's Scarborough 5, SE SW SW PSL 3, Blk C-22, failure in Grayburg at 3565 ft. **Oil Outlets:** Magnolia; Texas-New Mexico. **Principal Leaseholders:** Cities Service, Emperor, Gulf, Humble, Magnolia, S. W. Richardson, Richardson Oils, Shell, Sinclair, Texas Co. **Remarks:** Nearly all remaining wells are marginal producers. Field links with Kermit field to the south. No further development in regular pay due.

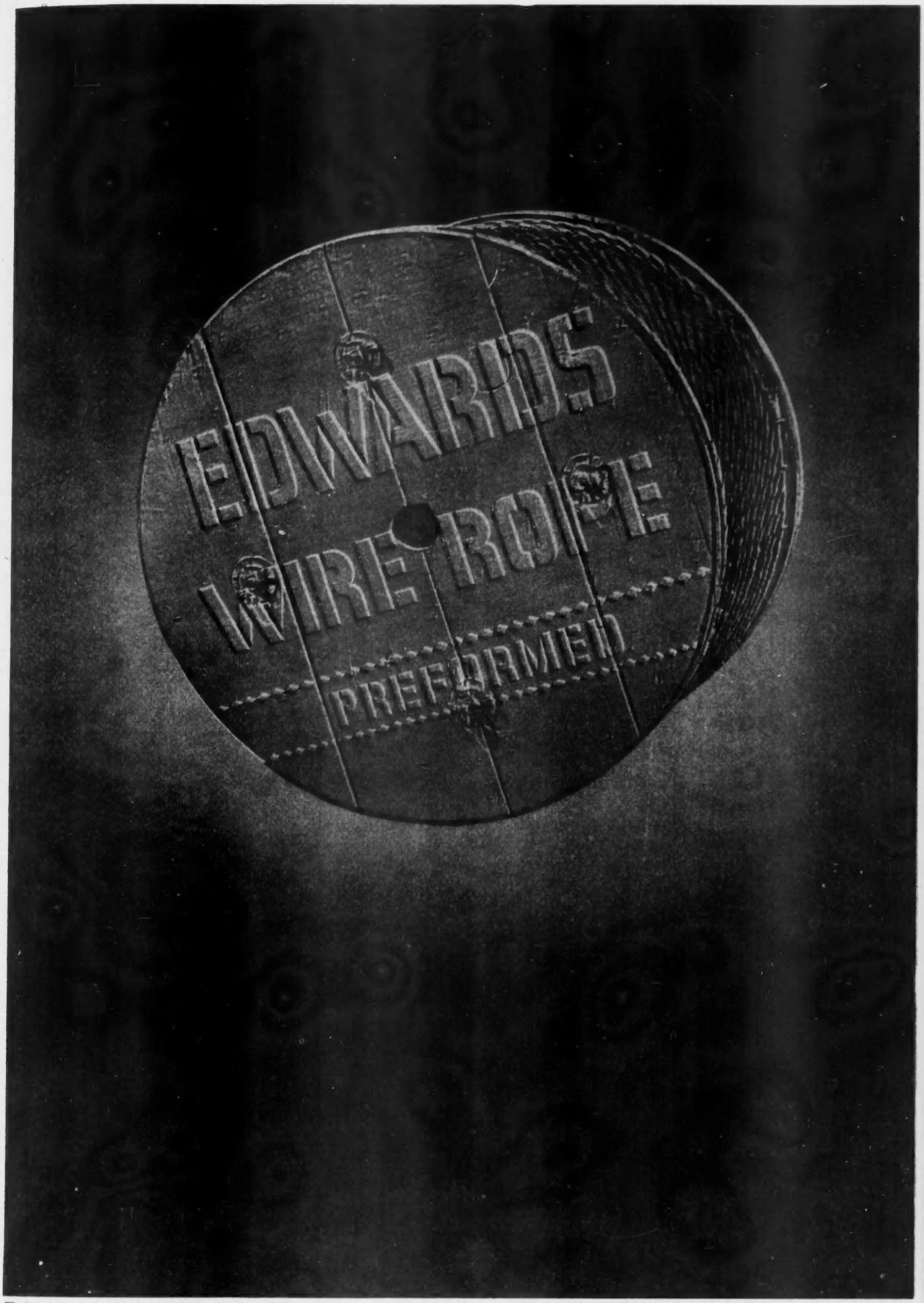
WEINER

Discovery Data: Geology. **Discovery Well:** Texas Co.'s Halley 1, SW SW SW PSL 7, Blk B-11, completed September 27, 1936, oil discovery. John R. Sharp's (was Sam Weiner et al) Halley-Texaco 1, C NW NE PSL 7, Blk B-11, completed August 13, 1941, due to junked hole as gasser. **Type of Structure:** Anticline. **Producing Formations:** Queen (Colby sand) 2934-3230 ft, averaging 94 ft of penetration. **Producing Area:** Developed: 2520 acres. **Production June 30, 1947:** Daily: 626 bbls. Cumulative: 1,892,810 bbls. Estimated remaining reserves: 10,707,000 bbls. **Producing Wells June 30, 1947:** 63. (flowing: 57; artificial lift: 6). **Gravity:** 33-36. **Rigs Running June 30, 1947:** None. **Deepest Test:** Skelly's Halley 56, SW SW NW PSL 8, Blk B-11, failure in San Andres at 3693-3896 ft. **Oil Outlets:** Magnolia. **Principal Leaseholders:** Continental, General American, Ralph Lowe, John R. Sharp, Skelly, Southern Union Gas Co., Stanolind, Sun, Texas Co., Texas Crude Oil Co., Westbrook Oil. **Remarks:** An abundance of prolific dry gas in 2300-ft zone will enable operators to utilize gas lift during greater portion of the stripper-well period. Developed on 20-acre spacing. The oil discovery assigned to Halley field prior to issuance of Weiner field proration order November, 1941. More development will occur to north of field.

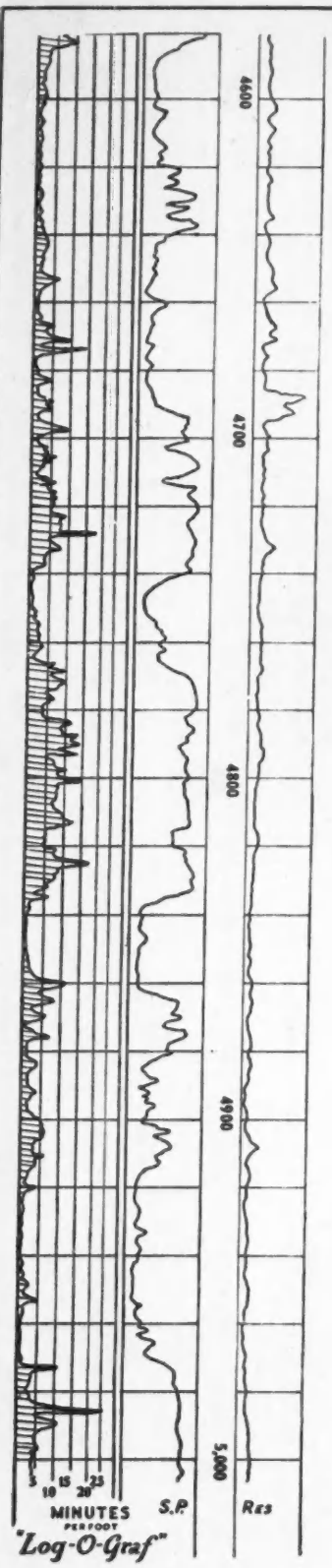
YOAKUM-GAINES

WASSON

Discovery Data: Geophysics-geology. **Discovery Well:** Honolulu-Cascade's Bennett-TP Coal & Oil 1, C NE NE Sect 678, Blk D, J. H. Gibson Sur. Yoakum County, completed April 6, 1936, discovery for Bennett field, later united with Wasson field. Amon G. Carter-Continental's Wasson 1, SW SW NW PSL 48, Blk A-X, Gaines County, completed June 19, 1937, 12½ miles southwest of Bennett area and called Wasson field. **Type of Structure:** Anticline. **Producing Formations:** San Andres 4960 ft (average) to 5158 ft (average), averaging 198 ft of pay. **Producingg Area:** Developed: 58,400 acres. Undeveloped: 600 acres. **Production June 30, 1947:** Daily: 67,160 bbls. Cumulative: 133,575,310 bbls. Estimated remaining reserves: 508,900,000 bbls. **Producing Wells June 30, 1947:** Total: 1561 (flowing: 1369; artificial lift: 192; depleted: 7). **Gravity:** 32-34. **Rigs Running June 30, 1947:** 3. **Deepest Test:** See Wasson Deep area. **Oil Outlets:** Atlantic, Shell, Stanolind. **Principal Leaseholders:** Fred M. Allison, Amerada, Anderson, Prichard, Argo, Atlantic, Bay, Amon Carter, Cities Service, Continental, DeKalb Agric.,

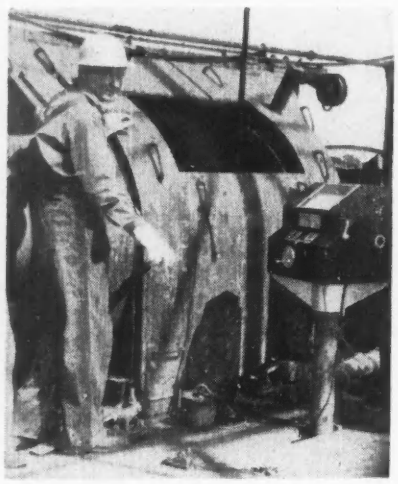


E. H. EDWARDS COMPANY — SEATTLE — PORTLAND — SAN FRANCISCO — LOS ANGELES — HOUSTON



Self-Potential and Resistivity Curves Superimposed on Log-O-Graf Chart.

NO REPLOTTING NECESSARY WITH "Log-O-Graf"



Geologists and Engineers—Here is a new and different tool that will enable you to have subsurface control while actual drilling is in progress. This instrument automatically records drilling time in minutes per foot in the form of a curve. Write for rental information and bulletin. Sold for export only.

MAKERS ALSO OF

"Mud-O-Graf" AND "Pit-O-Graf"

WARREN AUTOMATIC TOOL CO.

1920 HUSSION • HOUSTON, TEXAS

Denver Prod. & Ref., Devonian, Drilling & Explor. et al, General American, Gulf, Helmerich & Payne, Honolulu, Humble, Kerr, McGee, King & Bay Pet., Geo. P. Livermore, Mabee O & G, Magnolia, Mid-Continent, J. W. Murchison Oil Dev. Co., Phillips, Plymouth, Shell, Sinclair, Skelly, Stanolind, Sun, Texas Co., Texas Pacific, Tide Water. **Remarks:** Second largest producing area in district; former Bennett sector of field developed on 20-acre spacing and remainder on 40-acre units. Wells have unusually long flowing life, as only 12 percent on artificial lift. Deeper pays besides those present and discussed under separate heading remain promising, although will involve local highs.

YOAKUM

BENNETT

Discovery Data: Geophysical survey, surface geology. **Discovery Well:** Honolulu-Cascade's L. P. Bennett 1, April 6, 1936. **Type of Structure:** Anticline. **Producing Formations:** Permian Lime, brown and laminated, between 5090 and 5364 ft. **Gravity:** 34. **Deepest Test:** Discovery carried to 5283 ft from which it was pb to 5364 ft. **Oil Outlets:** Tank trucks. **Principal Leaseholders:** Honolulu, Cascade Pet., T. P. Coal & Oil, Mid-Continent, Siosi Oil Corp., Shell, Texas Co., Magnolia.

BRAHANEY

Discovery Data: Geology. **Discovery Well:** Dunigan Bros.-F. T. Brahaney (was Skelly Oil Co.) W. S. Hodges 1, C NW NW Sect 446, Blk D, J. H. Gibson Sur, completed June 26, 1945. **Type of Structure:** Anticline. **Producing Formations:** San Andres 5250-5292 ft, consisting of 42 ft of broken lime pay. **Producing Area:** 40 acres. **Production June 30, 1947:** Daily: 13 bbls. Cumulative: 11,346 bbls. **Estimated remaining reserves:** Unimportant. **Producing Wells June 30, 1947:** 1 pumping. **Gravity:** 32. **Rigs Running June 30, 1947:** None. **Deepest Test:** Discovery plugged back from Clear Fork at 7717 ft. **Oil Outlets:** Trucks. **Principal Leaseholders:** Discoverers. **Remarks:** Nearest San Andres failure is a mile north by west, thus emphasizing the possibility of enlargement of producing area.

OWNBY

Discovery Data: Geology and trend. **Discovery Well:** Geo. P. Livermore's E. Ownby-Shell 1, C NE NE Sect 502, Blk D, J. H. Gibson Sur, March 28, 1941. **Type of Structure:** Anticline. **Producing Formations:** San Andres (Perm) lime 5249-5313 ft, average 64 ft penetration. **Producing Area:** 1960 acres. **Production, June 30, 1947:** Daily: 1240 bbls. Cumulative 1,253,664 bbls. Estimated remaining reserves: 14,427,000 bbls. **Producing Wells June 30, 1947:** Total: 48 (flowing: 23; artificial lift: 25). **Gravity:** 30-35. **Rigs Running June 30, 1947:** None. **Deepest Test:** Texas Gulf Prod.'s E. C. Powell-Humble 1, C SW SE Sect. 4, Blk D, J. H. Gibson Sur, failure in San Andres 4750-5532 ft. **Oil Outlets:** Stanolind, Shell. **Principal Leaseholders:** Devonian, Drlg. & Expl., Great Western Prod., Geo. P. Livermore, Shell, Sinclair Prairie. **Remarks:** Nominal volume of inside drilling remains.

WAPLES-PLATTER

Discovery Data: Geology, geophysics, trend exploration. **Discovery Well:** Shell's Waples-Platter 1, SW SW NE Sect 616, Blk D, J. H. Gibson Sur, May 20, 1939, recompleted July 25, 1939. **Type of Structure:** Anticline. **Producing Formations:** San Andres (Perm) lime 5233-5290 ft, average 57 ft penetration. **Producing Area:** 640 acres. **Production June 30, 1947:** Daily: 173 bbls. Cumulative: 333,343 bbls. Estimated remaining reserves: 2,227,000 bbls. **Producing Wells June 30, 1947:** Total: 15 (flowing: 3; artificial lift: 11). **Gravity:** 32. **Rigs Running June 30, 1947:** None. **Deepest Test:** Forest Dev. Corp.'s A. C. Whisenant, Shell 1, 660 ft fr SEc Sect 553, Blk D, J. H. Gibson Sur, failure in San Andres at 5500 ft. **Oil Outlets:** Shell, Stanolind. **Principal Leaseholders:** Drlg. and Explor. Co., Seaboard, Shell, Texas Gulf Prod. Co. **Remarks:** Area has since become untied with northeast tip of Wasson field but officially classed as separate sector. Crude yield per acre below average for Wasson. Further development improbable.

WEST

Discovery Data: Geology. **Discovery Well:** Bond Oil Corp.-L. C. Harrison's (was Bohago Oil Corp.-Bond Oil Corp.) West 1, C SE NW Sect 606, Blk D, J. H. Gibson Sur, completed August 22, 1937. **Type of Structure:** Anticline. **Producing Formations:** San Andres 5122-5255 ft, broken saturation. **Producing Area:** 40 acres. **Production June 30, 1947:** Daily: 28 bbls. Cumulative: 77,930 bbls. Estimated remaining reserves: 75,000 bbls. **Producing Wells June 30, 1947:** 1 pumping. **Gravity:** 32. **Rigs Running June 30, 1947:** None. **Deepest Test:** Bohago & Bond's West 1, SEc Sect 607, Blk D, J. H. Gibson Sur, failure in San Andres at 5503 ft. **Oil Outlets:** Trucks. **Principal Leaseholders:** Bond Oil Corp., L. C. Harrison. **Remarks:** Four failures within 1 mile of producer discourages further development.

If the job needs...

BREAXIT

REGISTERED U. S. PAT. OFF.
By H.O.& R.Co.

WE BRING BREAXIT TO THE JOB

Quick to-the-lease delivery is part of the complete service offered by BREAXIT Emulsion Breaking Compounds. At your request a trained engineer will make a field trip and conduct BREAXIT tests on live oil on your lease.

These tests will prove what many other Gulf Coast producers have already discovered — that BREAXIT is the way to more profit through more pipeline oil. There is a complete family of BREAXIT compounds for use under any service condition, and our engineers are standing by to give you on-the-job recommendations. Call or wire for quick field service and prompt to-the-lease delivery.

HUMBLE OIL & REFINING COMPANY
Breaxit Division, • P. O. Box 2180, • Houston, Texas

or

THE CARTER OIL COMPANY
Marketing Dept. • • • Tulsa, Oklahoma

NEW MEXICO

LEA

ARROWHEAD

Discovery Data: Geology. **Discovery Well:** Continental's State 1-J-2, C NW NE 2-22s-36e, May 24, 1938. **Type of Structure:** Anticline. **Producing Formations:** Grayburg 3540-3870 ft, averaging 75 ft of penetration. **Producing Area:** Oil: 5080 acres. Gas: 200 acres. **Production June 30, 1947:** Daily: 4204 bbls. Cumulative: 12,284,406 bbls. Estimated remaining reserves: 48,676,000 bbls. **Producing Wells June 30, 1947:** Total oil: 124 (flowing: 115; artificial lift: 9). Gas: 3 active; 2 dormant. **Gravity:** 34-36. **Rigs Running June 30, 1947:** None. **Deepest Test:** Ohio's State-McDonald 2-A, C NW SW 14-22s-36e, showed possible oil production at 4190-99 ft, sulphur water at 4266-4350 ft; pb as gasser. **Oil Outlets:** Shell, Texas-New Mexico. **Principal Leaseholders:** Amerada, Cities Service, Continental, Gulf, Humble, Ohio, Repollo. **Remarks:** Development concluded except for an occasional west side test where either oil or dry gas possible. Deep production undetermined, but rated as good prospect. Field showing unusually long flowing life. About 65 wells making water, which totalled 393,740 bbls to January 1, 1947. Area is important source of gas, which is attainable above and in oil pay. Cumulative gas production to January 1, 1947, calculated at 27,924,000 mcf.

BLINEBRY

Discovery Data: Geology. **Discovery Well:** Texas Co.'s C. H. Lockhart No. 2, C NW NW Sect. 18-22s-38e, December 10, 1945. **Type of Structure:** Anticline. **Producing Formations:** Upper Yeso (Blinebry) 5560-5675 ft, average 40 ft penetration. **Producing Area:** Oil: 200 acres. Gas: 40 acres. **Production June 30, 1947:** Daily: 49 bbls. Cumulative: 38,567 bbls. Estimated remaining reserves: Not important. **Producing Wells June 30, 1947:** 5 flowing; 1 gas (dormant). **Gravity:** 38-50. **Rigs Running June 30, 1947:** None. **Deepest Test:** Discovery plugged back from granite at 7560-97 ft. **Oil Outlets:** Texas-New Mexico. **Principal Leaseholders:** DeKalb Agricultural Assn., Gulf, Penrose, Texas Co. **Remarks:** All wells are marginal producers. Area involves a stray oil pay between original Drinkard and Paddock fields. Granite eliminates deeper production.

BOWERS

Discovery Data: Geology. Higher pay encountered during drilling of deeper regular pay in Hobbs area. **Discovery Well:** Tide Water's State 1 SEc SE NE Sect 14-18s-37e, December 30, 1935. **Type of Structure:** Anticline. **Producing Formations:** Bowers Sand (Perm) 3145-3359 ft, average 12 ft penetration. **Producing Area:** Developed: 920 acres. **Production June 30, 1947:** Daily: 581 bbls. Cumulative: 96,727 bbls. Estimated remaining reserves: 4,043,000 bbls. **Producing Wells June 30, 1947:** 23 flowing. **Gravity:** 38-42. **Rigs Running June 30, 1947:** 3. **Deepest Test:** See Hobbs field. **Oil Outlets:** Shell, Atlantic, Humble. **Principal Leaseholders:** Tide Water, Amerada, Continental, Humble, Shell, Standard of Texas, Pacific Western. **Remarks:** Above cumulative production includes 20,179 barrels produced by discovery well which has been carried as a Hobbs pool well, and is the most northwesterly producer. Standard of Texas' State 1-29, depleted Hobbs field regular pay well, was plugged back and recompleted October 29, 1946, in Bowers sand, thus starting development of the upper pay, which embraces a substantial area, although a thin pay.

BRUNSON

Discovery Data: Geology-geophysics. **Discovery Well:** N. G. Penrose et al's Penrose-Federal 1, C SE NW 9-22s-37e, completed September 14, 1945. **Type of Structure:** Anticline, **Producing Formations:** Ellenburger 7410-8229 ft, average 76 ft penetration. **Producing Area:** 1360 acres. **Production June 30, 1947:** Daily: 3834 bbls. Cumulative: 837,566 bbls. Estimated remaining reserves: 33,162,000 bbls. **Producing Wells June 30, 1947:** 34 flowing. **Gravity:** 38-43.7. **Rigs Running June 30, 1947:** 10. **Deepest Test:** Gulf's Baker 3, 2086 ft from nls and 554 ft from ewl Sect 5-22s-37e. Plugged back from Ellenburger dolomite at 8291 ft. **Oil Outlets:** Shell, Humble, Texas-New Mexico. **Principal Leaseholders:** Amerada, Cities Service, Gulf, Humble, Magnolia, N. G. Penrose, Shell, Skelly, Stanolind, Tide Water. **Remarks:** Involves first important Ellenburger production for state; area will record the highest crude yield per acre for a given pay. Flush production from underlying granite-wash beds not included by some wells. Flowing production from overlying Simpson (middle Ordovician) passed up by some Ellenburger wells, and will be developed later this year. Brunson area covers portion of original Penrose and Hardy regular-Permian fields, and is subject to major extensions to north and south. Defined to east by high granite and to west by dip in structure.

CAPROCK

Discovery Data: Geology. **Discovery Well:** George P. Livermore's (was Great Western Producers) State 1-D-a, C SE SE 30-12s-32e, November 26, 1940. **Type of Structure:** Anticline. **Producing Formations:** Queen 3012-85 ft, averaging 9 ft of penetration. **Producing Area:** 3000 acres. **Production June 30, 1947:** Daily: 2800 bbls. Cumulative: 668,551 bbls. Estimated remaining reserves: 9,832,000 bbls. **Producing Wells June 30, 1947:** Total: 75 (flowing: 56; artificial lift: 19). **Gravity:** 36-38. **Rigs Running June 30, 1947:** 7. **Deepest Test:** Discovery plugged back from San Andres at 4385 ft. **Oil Outlets:** Stanolind. **Principal Leaseholders:** British-American, Cooperative Prod. Assn., Delfern Oil, Great Western Producers, Malco Refineries. **Remarks:** Field offers unusually thin pay, but some wells registered prolific flow from top of sand. Development retarded through isolation from market outlet, then single pipe line connection to refinery at Roswell unable to absorb the allowable, causing stringent pipe line proration until Stanolind entered with 8-inch trunk line from West Texas about mid-1947. Field subject to substantial enlargement.

CASS

Discovery Data: Geology-geophysics. **Discovery Well:** Continental et al's J. Skaggs 2-B-23, C SW NW 23-20s-37e, completed December 20, 1944. **Type of Structure:** Anticline **Producing Formations:** Strawn (Penn) sandy lime 7667-7725 ft, averaging 22 ft of penetration. **Producing Area:** 120 acres. **Production June 30, 1947:** Daily: 273 bbls. Cumulative: 166,022 bbls. Estimated remaining reserves: 134,000 bbls. **Producing Wells June 30, 1947:** 3 flowing. **Gravity:** 41.7-42.3. **Rigs Running June 30 1947:** 1. **Deepest Test:** Discovery well plugged back from granite 10,430-465 ft. Ellenburger not present. **Oil Outlets:** Atlantic. **Principal Leaseholders:** Continental et al. **Remarks:** Involves only Pennsylvanian production in county. Small producing area.

COOPER-JAL

Discovery Data: Cooper Sector: Wildcat gasser in upper Permian deepened to oil. Jal Sector: Geological trend. **Discovery Well:** Cooper Sector: General Crude (was Cranfill & Reynolds) and Magnolia's A. E. Meyers 1, NEc SE 22-24s-36e, July 16, 1929, as 70 mln-ft gasser, td 3438 ft; deepened to 3508 ft, recompleted April 13, 1934. Jal Sector: Skelly's Joyner 1, NE NE SE 26-25s-36e, January 30, 1929. Conoco et al's Sholes 1, NW NW SE 19-25s-37e, completed January 25, 1929, as gas discovery. **Type of Structure:** Anticline. **Producing Formations:** Cooper Sector: Seven Rivers, 3410-3699 ft, average 35 ft penetration. Jal Sector: Seven Rivers 3256-3462 ft, average 34 ft penetration. **Producing Area:** Combined oil: 7840 acres. Gas: 1120 acres. **Production June 30, 1947:** Daily: 2162 bbls. Cumulative: 24,415,952 bbls. Estimated remaining reserves: 53,984,000 bbls. **Producing Wells June 30, 1947:** Total oil: 101 (flowing: 20; artificial lift: 81). Depleted or converted to gas: 88. Total gas: active: 19; dormant: 9. **Gravity:** 28-30. **Rigs Running June 30, 1947:** 1. **Deepest Test:** Humble's S. R. Cooper 1, C NW NE Sect 23-24s-36e, failure in Yeso at 7171 ft. **Oil Outlets:** Texas-New Mexico. **Principal Leaseholders:** Amerada, Barnsdall, Cities Service, Continental, General Crude, Gulf, Humble, Ralph Lowe, Repollo, Skelly, Texas Co., Texas Pacific. **Remarks:** Recovery to date in excess of 3100 bbls per acre. Of the 234 wells drilled, 88 oil wells have been shut in or plugged and abandoned, and 6 converted to gas wells. Nineteen wells produce gas only. About 225 million bbls of water have been produced in the field, including 12,592,000 bbls in 1946. This water drive is a factor in comparatively high average oil output per acre. North portion of prorated area was classified as Lynn field.

• Large capacity, compact design, and lightweight aluminum construction are combined in this new, rugged, portable electric plant. Easily carried by two men. Powered by Onan 10 HP horizontally-opposed, two-cylinder, 4-cycle, air-cooled engine. Unusual operating economy. Shipped complete, equipped with four-receptacle outlet box and mounted in tubular-steel guard frame.

NEW ONAN CK ELECTRIC PLANTS are available in 5,000 Watts D.C., 115 and 230 volts; 2000 and 3000 Watts A.C. in all standard voltages.

ONAN ELECTRIC PLANTS—*A.C.: 350 to 35,000 Watts in all standard voltages and frequencies. D.C.: 600 to 15,000 Watts, 115 and 230 Volts. Battery Chargers: 500 to 6,000 Watts, 6, 12, 32 and 115 Volts.*

ONAN AIR-COOLED ENGINES—*CK: 2-cylinder opposed, 10 HP. BH: 2-cylinder opposed, 5.5 HP. IB: 1-cylinder, 3.25 HP.*

D. W. ONAN & SONS INC.
4750 Royalston Ave., Minneapolis 5, Minn.

Onan PRODUCTS

Write for Catalog

ONAN ELECTRIC PLANTS

Two More California Fields Report...

MUD CONTROL IMPROVED

with CYANAMID'S Aerotan *

NEW WATER-LOSS CONTROL REAGENT

Reports on drilling mud control obtained with Cyanamid's AEROTAN water-loss control reagent continue to be highly favorable. Following tests made in various wells in the Coalinga Kettleman Hills district of California another company has joined the growing ranks of those using this water-loss control reagent exclusively. The decision was based not only on its proven superiority in reducing water loss but also on its convenience and ease of handling as a viscous liquid.

In the Cymric district, also in California, results show that in a cement contaminated mud treated with AEROTAN control reagent the water loss was 4 cc API lower than when the same mud was treated with conventional materials.

These reports confirm other reports from California's Paloma and Elk Hill fields. In these fields, test wells using AEROTAN control reagent have shown outstanding improvement in the reduction of water loss, elimination of tight spots, quality of filter cake . . . plus substantial savings in handling and application.

For complete information get in touch with American Cyanamid Company, 229 Shell Building, Houston, Texas, or Azusa, California. *Trade-mark

When Performance Counts...Call on Cyanamid

SEE OUR EXHIBIT PACIFIC CHEMICAL EXPOSITION SAN FRANCISCO CIVIC AUDITORIUM OCTOBER 21-25 INC. 1947

... It's liquid

CUTS TIME AND COSTS

AEROTAN water-loss control reagent is a viscous liquid supplied in small drums or wooden kegs. Can be applied directly to the mud stream without waste of time or material. It is completely soluble—entirely absorbed by the drilling mud without loss to the formation. No heat is required for complete solution. It is not adversely affected by high temperatures. Thoroughly laboratory and field tested both on an experimental and commercial basis.

SAYS DRILLER DAN:

"Here's liquid refreshment for your mud control program," says Driller Dan. "It's AEROTAN *liquid* water-loss control reagent specially designed to speed up handling and application."

AMERICAN Cyanamid COMPANY

Industrial Chemicals Division

30 ROCKEFELLER PLAZA · NEW YORK 20, N. Y.

CORBIN

Discovery Data: Geology. **Discovery Well:** Helmerich & Payne's (was Texas Co.) M. A. Corbin 1 C NW SW 10-18s-33e, June 28, 1938. **Type of Structure:** Anticline. **Producing Formations:** Queen 4255-4350 ft, average 63 ft penetration. **Producing Area:** Oil: 80 acres. Gas: 40 acres. **Production June 30, 1947:** Cumulative: 64,677 bbls. Estimated remaining reserves: Depleted. **Producing Wells June 30, 1947:** 1 gas well, dormant. **Gravity:** 30-31. **Rigs Running June 30, 1947:** None. **Deepest Test:** Discovery plugged back from water in Grayburg at 5118 ft. **Remarks:** Oil recovery was 808 barrels per acre, produced from 2 wells. Outlying failures discourage renewal of development.

DRINKARD

Discovery Data: Geology - geophysics. **Discovery Wells:** Gulf's Drinkard 1, C NE NW 30-22s-38e, completed October 25, 1944, first Yeso (Drinkard) pay discovered in county; Gulf's State-Andrews 1, C NW NE 32-22s-38e, completed May 22, 1945, first Basal Yeso (Wichita-Albany) pay in county. N. G. Penrose's Jones 1, C SW SW 6-22s-38e, completed November 26, 1945, first Lower Leonard pay discovery for county. Gulf's Amanda Drinkard 1, C NW SE 25-22s-37e, completed June 4, 1947, Lower Leonard gas-distillate pay discovery. Gulf's Paddock 3, C SE SE 1-22s-37e, completed September 2, 1946, gasser in 6200-ft Yeso (Tubb) zone. **Type of Structure:** Anticline. **Producing Formations:** Yeso (Drinkard) 6390-6900 ft, averaging 46 ft of penetration. Basal Yeso 6785-7120 ft, averaging 94 ft of broken pay penetration. Lower Leonard 7040-7160 ft; 1 well. Lower Leonard (gas-distillate) 7025-65 ft; 1 well. Yeso (Tubb) Gas 6150-6250 ft; 1 well. **Producing Area:** 5640 surface acres (all zones). **Production June 30, 1947:** Daily: 9418 bbls. Cumulative: 1,250,525 bbls. (all zones). Estimated remaining reserves: 52,590,000 bbls (all zones). **Producing Wells June 30, 1947:** Total: 141 (flowing: 140; artificial lift: 1). Gas: 2. **Gravity:** Yeso (Drinkard) 37-41; Basal Yeso 37-41.6; Lower Leonard 39. **Rigs Running June 30, 1947:** 30. **Deepest Test:** See Brunson field. **Oil Outlets:** Magnolia, Shell, Humble, Texas-New Mexico. **Principal Leaseholders:** Amerada, Anderson-Prichard, Barnsdall, Cities Service, Conoco, Gulf, Humble, Magnolia, E. F. Moran, Mid-Continent, Ohio, R. Olsen, Pacific Western, Penrose, Repollo, Rowan Samedan, Shell, Skelly, Stanolind, Southern Pet. Explo., Trinity Drlg. Co., Tide Water, Western Gas. **Remarks:** Yeso (Drinkard) pay extends along northwest-southeast trend for 12 miles, with the north end subject to major extensions, overlapping portions of several old regular-Permian fields. Pays other than the Yeso (Drinkard) included under the Drinkard field classification are erratic and not generally profitable. It is significant that 10 percent of the Drinkard field wells have declined to marginal-well status. Reservoir pressure readings forecast accelerated decline in pressure, but an abundance of gas overlies the oil pay to employ gas-lift when needed.

DUBLIN

Discovery Data: Geophysics. **Discovery Well:** Humble's Leonard-Federal 1, C SW SW 12-26s-37e, completed November 20, 1944. **Type of Structure:** Anticline. **Producing Formations:** Ellenburger 11,890-928 ft. **Producing Area:** 40 acres. **Production June 30, 1947:** Cumulative: 38,847 bbls. Estimated remaining reserves: Depleted. **Producing Wells June 30, 1947:** None. **Gravity:** 48.9. **Rigs Running June 30, 1947:** None. **Deepest Test:** Humble's Leonard-Federal 1-B, C SW NW 12-26s-37e, ½ mi n of discovery and 646 ft low on Ellenburger, topped at 12,465 ft; failure at 12,535 ft. **Oil Outlets:** Humble. **Principal Leaseholders:** Humble controls area. **Remarks:** Discovery developed excessive water with oil, was plugged January, 1947, after thorough test of all upper zones that registered porosity. Humble's Leonard-Federal 2 2/3-miles se of discovery, abandoned at 9861 ft due to correlating 577 feet on Devonian, topped at 9795 ft. Discovery was first Ordovician producer for state and deepest

EAVES

Discovery Data: Geology and trend. **Discovery Well:** Continental et al's (was Marland et al) Eaves 1, SW SW SE 19-26s-37e, gas discovery, December 1928; same group's McCallister 1-A, SW SW SE 24-26s-36e, oil discovery September 13, 1929. **Type of Structure:** Reef. **Producing Formations:** Yates and Seven Rivers 2938-3285 ft, average 40 ft penetration. **Producing Area:** Oil: 1040 acres. Gas: 40 acres. **Production June 30, 1947:** Daily: 887 bbls. Cumulative: 3,763,429 bbls. Estimated remaining reserves: 4,557,000 bbls. **Producing Wells June 30, 1947:** Total Oil: 24 (flowing: 12; artificial lift: 12). Depleted: 2. Gas: 1 (active). **Gravity:** 27-34. **Rigs Running June 30, 1947:** None. **Deepest Test:** Cranfill-Reynolds-Magnolia's State 1-A, NE SE SE 23-26s-36e, failure in Seven Rivers at 3500 ft. **Oil Outlets:** Humble, Texas-New Mexico, Stanolind. **Principal Leaseholders:** Continental et al, Gulf, Stanolind. **Remarks:** Crude contains exceptionally desirable lube content. Only 3 wells, including the discovery, fail to produce their top allowable. Recovery per acre in excess of 3700 bbls. to date. Water production is currently 3 times that of oil, but this water drive contributes to comparatively high crude yield per acre.

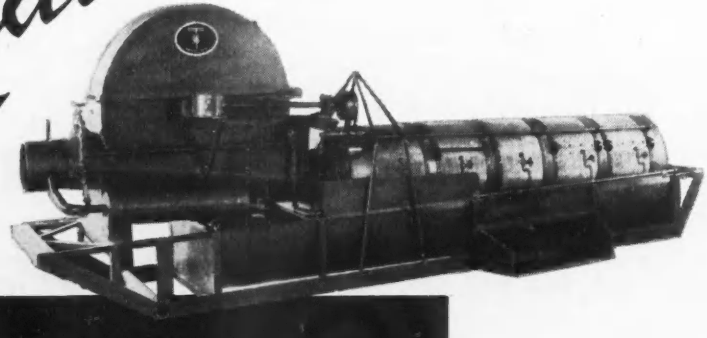
EUNICE-MONUMENT

Discovery Data: Eunice Sector: Surface geology. Monument Sector: Geology-geophysics **Discovery Well:** Eunice Sector: Continental et al's (was Marland Oil Co. et al) Lockhart 1-B-31, NE NW NW 31-21s-36e, March 1929. Monument Sector: Amerada's State 1-D, C NW NW 1-20s-36e, February 23, 1935. **Type of Structure:** Anticline. **Producing Formations:** Eunice Sector: Grayburg 3730-4000 ft, average 79 ft penetration. Monument Sector: Grayburg and San Andres 3740-4050 ft, average 88 ft penetration. **Producing Area:** Oil: 40,000 acres. Gas: 400 acres. **Production June 30, 1947:** Daily: 30,382 bbls. Cumulative: 167,546,951 bbls. Estimated remaining reserves: 172,453,000 bbls. **Producing Wells June 30, 1947:** Total: 974 (flowing: 806; artificial lift: 168). Depleted or converted to gas: 26. Gas Active: 3. Dormant: 7. **Gravity:** 32-37. **Rigs Running June 30, 1947:** 1. **Deepest Test:** Amerada's Phillips 5, C NE NE 1-20s-36e, near apex of Permian structure in Monument Sector, passed up prolific oil flow in Glorietta (Paddock) and drilling below 8000 ft on Ellenburger objective. **Oil Outlets:** Texas-New Mexico, Atlantic, Shell, Humble, Gulf, Warren Pet. **Principal Leaseholders:** Amerada, Atlantic, Cities Service, Continental, Gulf, Humble, Repollo, Shell, Skelly, Standard of Texas, Stanolind, Sun, Texas Co., Tide Water, Ohio, Phillips, Superior. **Remarks:** Oil recovery to date has been approximately 4200 bbls per acre. Total gas produced from the field has been 556 million mcf. This combined area is largest in state. Total of 307 wells, or about one-third of the active producers have settled to marginal-well basis. Deeper Permian oil zones, and possibly pre-Permian oil zones, will result in considerable twin-drilling. Development of the Glorietta pay will get underway before end of year.

EUNICE SOUTH

Discovery Data: Extension from Eunice. **Discovery Well:** Cities Service's (was Empire) Closson 1, NE NW SE 6-22s-36e, May 28, 1930. **Type of Structure:** Anticline. **Producing Formations:** Seven Rivers 3716-3884 ft, average 70 ft penetration. **Producing Area:** Oil: 3960 acres. Gas: 240 acres. **Production**

Leading THE FIELD AS ALWAYS..



THE Thompson SHALE SEPARATOR AND SAMPLE MACHINE

Thompson, the pioneer of the Self-Motivated Shale Separator, continues to lead the field, as it introduces its new Model "DW." Capable of handling the flow of mud from the largest mud pumps in operation. The Power Wheel has been redesigned to give it greater strength and more efficiency. Shale and abrasives are removed from your drilling mud . . . saving unnecessary wear on costly drilling equipment.

SAMPLE MACHINE is standard equipment, unless otherwise specified. Proven method of obtaining accurate samples of cuttings and mud.

Thompson manufactures three models of shale separators, providing an efficient size for every drilling requirement. These machines are available NOW through your supply dealers or direct from:

THOMPSON TOOL CO.
IOWA PARK, TEXAS

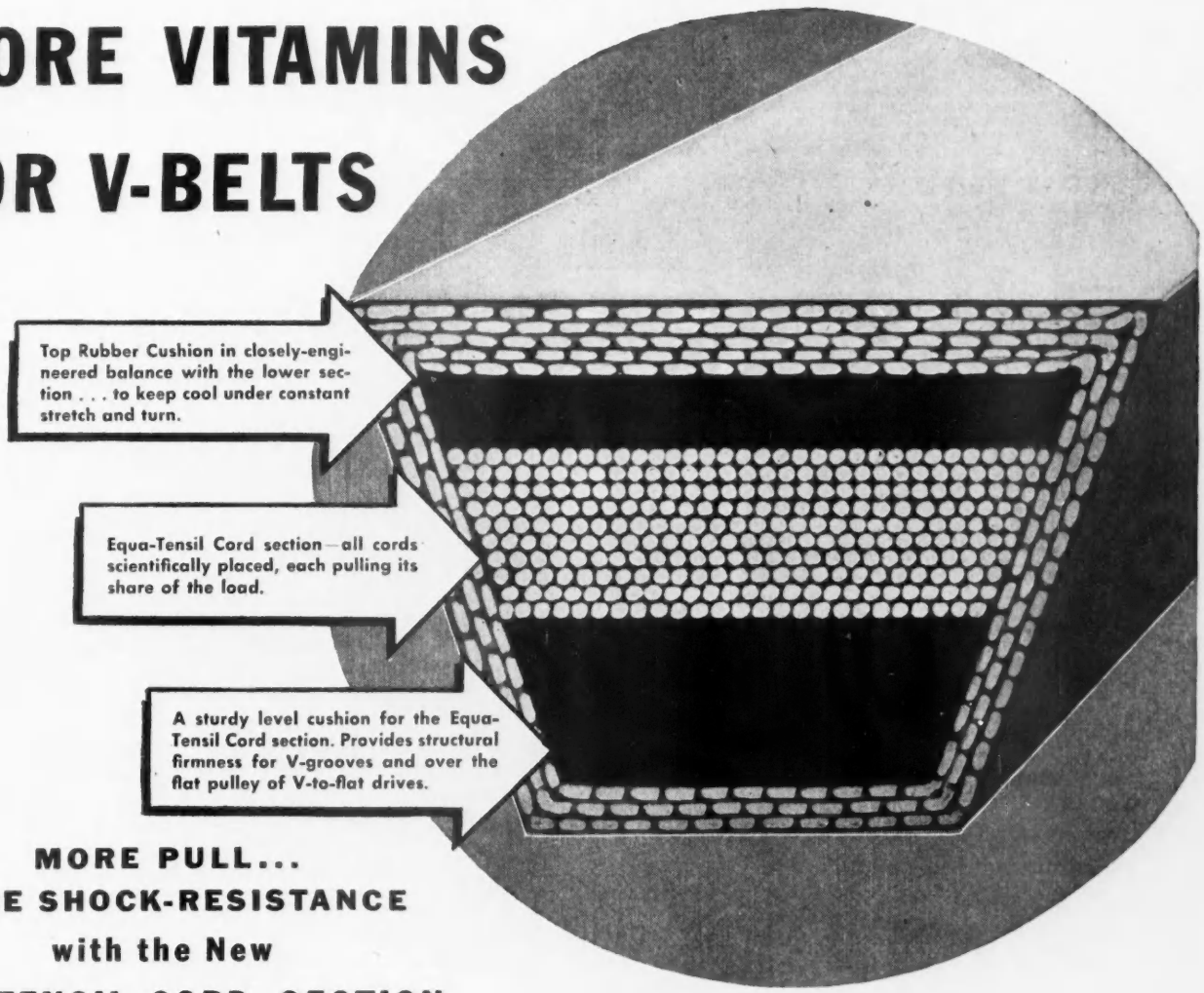
- SELF-MOTIVATED
- RECONDITIONS MUD
- ACCURATE SAMPLES
- UNLIMITED CAPACITY

KEEPS DRILLING MUD CLEAN — PROVIDES TRUE SAMPLES OF CUTTINGS

UNITED STATES RUBBER COMPANY

SERVING THROUGH SCIENCE

THIS SANDWICH MEANS MORE VITAMINS FOR V-BELTS


Top Rubber Cushion in closely-engineered balance with the lower section . . . to keep cool under constant stretch and turn.
Equa-Tensil Cord section—all cords scientifically placed, each pulling its share of the load.
A sturdy level cushion for the Equa-Tensil Cord section. Provides structural firmness for V-grooves and over the flat pulley of V-to-flat drives.

MORE PULL...
MORE SHOCK-RESISTANCE
with the New

EQUA-TENSIL CORD SECTION

Here's a sandwich that gives Rainbow V-Belts the extra strength and resiliency for tough jobs. Top and bottom are sturdy rubber cushions—in between are multiple pulling cords concentrated in one unit, the "Equa-Tensil Cord Section" of exceptional strength and stamina. Each cord pulls its balanced share of the load . . . the entire belt can absorb rougher shocks and take heavier loads.

But Rainbow V-Belts are powered with even more "vitamins." Straight sidewalls grip the grooves for more complete contact all the full height of the belt, thus increasing the pulling power . . . protective jackets increase the grip while keeping out dirt, a feature that prolongs the life . . . and, low stretch characteristics spell lower operating costs.

All lengths of Rainbow V-Belts are inherently matched by precise methods of manufacture for multiple use and are interchangeable with all standard makes.

U. S. RAINBOW MULTIPLE V-BELTS

WITH THE EQUA-TENSIL CORD SECTION

June 30, 1947: Daily: 1864 bbls. Cumulative: 8,971,821 bbls. Estimated remaining reserves: 18,748,000 bbls. **Producing Wells June 30, 1947:** Total Oil: 91 (flowing: 83; artificial lift: 8). Depleted or converted to gas: 8. Gas: active: 3; dormant 3. **Gravity:** 32-33. **Rigs Running June 30, 1947:** 2. **Deepest Test:** Ohio Oil's State-McDonald 5, C SE NW 16-22s-36e, temporarily deepest in county, logged nominal oil and gas shows in Glorietta, td 6202 ft in Yeso; pb to regular pay in 1947. **Oil Outlets:** Texas-New Mexico, Shell, Humble. **Principal Leaseholders:** Cities Service, Continental, Gulf, Texas-Pacific, Repollo, Shell, Ohio, Mid-Continent. **Remarks:** Adjoins Eunice-Monument field to the north. More oil development pending, while area affords huge reserve of dry gas that will be developed as market for gas expands. Deeper oil zones quite probable.

EUNICE WEST

Discovery Data: Subsurface geology. **Discovery Well:** Empire Gas & Fuel's State-Dexter 1-B, NE NE NW 8-21s-35e, completed July 27, 1928, discovery for area. Wilson Oil's State 1, C SW NE 7-21s-35e, completed October 28, 1938, discovery of what became main field. **Type of Structures:** Anticline. **Producing Formations:** Seven Rivers 3522-3858 ft, averaging 32 ft of penetration. **Producing Area:** 1320 acres. **Production June 30, 1947:** Daily: 1135 bbls. Cumulative: 2,154,415 bbls. Estimated remaining reserves: 8,086,000 bbls. **Producing Wells June 30, 1947:** Total 32 (flowing: 16; artificial lift: 16; depleted: 1). **Gravity:** 31-32. **Rigs Running June 30, 1947:** 2. **Deepest Test:** Empire's State 3-B, SW NE SE 5-21s-35e, failure at 4695 ft. **Oil Outlets:** Texas-New Mexico. **Principal Leaseholders:** Stanolind, Wilson et al. **Remarks:** Discovery produced 66,569 bbls and abandoned. Main field developed mile southwest, and has accounted for an occasional prolific production from top of pay. Dry holes preclude any appreciable enlargement of field.

GARRETT

Discovery Data: Geology. **Discovery Well:** Texas Co.'s W. C. Garrett 1, C NE SE Sect 22-16s-38e, completed April 9, 1947. **Type of Structure:** Anticline. **Producing Formations:** San Andres, 5300-5690 ft, involving 390 ft of nominally saturated lime pay zone. **Producing Area:** 40 acres. **Production June 30, 1947:** Daily: 18 bbls. Cumulative: new pool. Estimated remaining reserves: negligible. **Producing Wells June 30, 1947:** 1 pumping. **Gravity:** 27. **Rigs Running June 30, 1947:** None. **Deepest Test:** Texas Co.'s Eaves 1, C SE NE 26-16s-38e, failure in unidentified lime at 10,085 ft. **Oil Outlets:** Trucks. **Principal Leaseholders:** Texas Co. **Remarks:** While discovery is a marginal pumper, more attractive production will likely be developed in area.

HALFWAY

Discovery Data: Geology. **Discovery Well:** Argo Oil's (was Frank Farley-Peck & Croft) State-Texaco 1-A, C NE SW 16-20s-32e, October 18, 1939. **Type of Structure:** Anticline. **Producing Formations:** Yates 2615-90 ft, average 8 ft penetration. **Producing Area:** 360 acres. **Production June 30, 1947:** Daily: 129 bbls. Cumulative: 550,241 bbls. Estimated remaining reserves: 220,000 bbls. **Producing Wells June 30, 1947:** 5 pumping, 4 depleted. **Gravity:** 25-26. **Rigs Running June 30, 1947:** None. **Deepest Test:** Western Drlg & Engineering Co.'s State 1, SE NE NE 16-20s-32e failure in Queen at 4013 ft. **Oil Outlets:** Texas-New Mexico. **Principal Leaseholders:** Argo, Montecito Corp. **Remarks:** Four oil wells have been plugged and abandoned. Development terminated by failures.

HARDY

Discovery Data: Surface Geology. **Discovery Well:** Barnsdall Oil Co.'s Hardy 1, C SE NE 29-21s-37e, March 27, 1936. **Type of Structure:** Anticline. **Producing Formations:** Grayburg lime, 3555-3835 ft, average 98 ft penetration. **Producing Area:** 1600 acres. **Production June 30, 1947:** Daily: 287 bbls. Cumulative: 1,923,631 bbls. Estimated remaining reserves: 1,276,000 bbls. **Producing Wells June 30, 1947:** Total: 39 (flowing: 17; artificial lift: 22). Depleted: 1. **Gravity:** 36-38. **Rigs Running June 30, 1947:** None. **Deepest Test:** Discussed under Brunson. **Oil Outlets:** Shell. **Principal Leaseholders:** Continental, Skelly, Stanolind, Two States Oil. **Remarks:** All wells have declined to marginal status. Crude yield per acre below par for Grayburg. However, deeper oil zones, discussed under other headings, afford multiple drilling

HARRISON

Discovery Data: Geology. **Discovery Well:** Amerada's State 1-PB, C SW SW 16-23s-37e, completed November 11, 1945. **Type of Structure:** Anticline. **Producing Formations:** Glorietta (Holt) lime of Permian age from 5015-65 ft. **Producing Area:** 40 acres. **Production June 30, 1947:** Daily: 52 bbls. Cumulative: 7379 bbls. Estimated remaining reserves: Not important. **Producing Wells June 30, 1947:** Total: 1 pumping. **Gravity:** 39. **Rigs Running June 30, 1947:** None. **Deepest Test:** Skelly's Steeler 2, C NE NE 17-23s-37e, failure in Ellenburger at 10,528-589 ft. **Oil Outlets:** Shell. **Principal Leaseholders:** Amerada. **Remarks:** Discovery offsets Grayburg production; is incapable of making its allowable.

HOBBS

Discovery Data: Geophysics. **Discovery Well:** Stanolind's (was Midwest Refining Co.) State 1, NEc 9-19s-38e, November 1928 (regular pay). Tide Water's State 1, SE SE NE 14-18s-37e, December 30, 1935 (Bowers sand). **Type of Structure:** Anticline. **Producing Formations:** San Andres 3975-4253 ft, average 127 ft penetration. **Producing Area:** Oil: 10,900 acres. Gas: 120 acres. **Production June 30, 1947:** Daily: 9450 bbls. Cumulative: 117,895,189 bbls. Estimated remaining reserves: 78,305,000 bbls. **Producing Wells June 30, 1947:** Total: 250 (flowing: 209; artificial lift: 41). Depleted, plugged back or converted to gas: 10. Gas: active: 3. **Gravity:** 31-36. **Rigs Running June 30, 1947.** None. **Deepest Test:** Sun's H. D. McKinley 1-B, SW SW NE Sect. 20-18s-38e, northeast edge of structure and failure in Basal Permian at 8010 ft. **Oil Outlets:** Shell, Atlantic, Humble. **Principal Leaseholders:** Amerada, Atlantic, Cities Service, Continental, Gulf, Humble, Ohio, Pacific Western, Repollo Samedan, Shell, Skelly, Stanolind, Sun, Texas Co., Texas Pacific, Tide Water. **Remarks:** Recovery to date has been 10,800 bbls per acre. Over 42 million bbls of water have been produced, along with 233 million mcf of gas. Only 10 wells are currently classed as marginal producers. Shallower oil pay passed up is discussed under Bowers field. Deeper pay prospects not dimmed by the single off-structure Basal Permian failure, which encountered porosity and favorable showings below San Andres.

JUSTIS
(GAS)

Discovery Data: Geophysics. **Discovery Well:** R. Olsen Oil-Atlantic's Langlie-Justis 1, C SE SE 11-25s-37e, completed April 4, 1944. **Type of Structure:** Anticline. **Producing Formations:** Glorietta (Paddock) 4707-4880 ft, averaging 56 ft of penetration. **Producing Area:** 160 acres. **Production June 30, 1947:** Cumulative: 516,161,000 cubic feet to January 1, 1947. Estimated remaining reserves: Undetermined. **Producing Wells June 30, 1947:** Total: 4 (active: 3; shut in: 1). **Rigs Running June 30, 1947:** None. **Deepest Test:** Discovery plugged back from granite at 9555-92 ft, having logged barren Ellenburger at 9110-9555 ft. **Gas Outlet:** El Paso. **Principal Leaseholders:** Atlantic, R. Olsen, Western Natural Gas. **Remarks:** This gas discovery was first pre-Permian test

Bottom Water is a costly profit leak

Eagle Lead Wool

stops Bottom Water!

You rule out the risk of oil-wasting bottom water shutdowns when you tamp Eagle Lead Wool in the hole. This finely stranded, non-corrosive metallic wool makes a water-tight plug that seals every crack and crevice. Comes in convenient 50-pound sacks—easy to place in special cartridge-shaped Eagle Wire Containers sized to fit all casings. Order through your jobber today.

These 3 Eagle Bearing Metals meet most requirements

Eagle Dreadnaught—for extreme speed and heavy-duty conditions.

Eagle Outlasta—for medium speed and average-load conditions.

Eagle Durable—for low speed and light-duty conditions.

EAGLE LEAD WOOL

Seals off Bottom Water—keeps 'em flowing!

THE EAGLE-PICHER COMPANY

EAGLE Since EP 1843 PICHER

Cincinnati • East St. Louis • Chicago • Dallas Kansas City

It's a case of TWO being much better than one

THE MARTIN DECKER 2-PEN SLUSH PUMP GAUGE RECORDER

Cement trucks work under widely varying conditions. Regardless of whether low pressure or high pressure is encountered, the cementer must be prepared to cope with any situation and still have records that tell a complete story. When a one-pen cement recorder is used, either range or accuracy is sacrificed. The new Martin-Decker Two-Pen Slush Pump Gauge Recorder solves this problem by furnishing in a single unit maximum capacity and a detailed record of pressures encountered and time required to put away the cement.

The capacity from 0 to 6,000 lbs. is automatically covered by one pressure element but two pen arms. Pressures from 0 to 2,000 lbs. are recorded by pen arm No. 1 which travels the entire width of the chart, thus providing a maximum detail for the low pressure cement job. When pressure in excess of 2,000 lbs. is encountered, the second pen arm moves forward and travels the entire width of the chart from 2,000 lb. to 6,000 lb., thus providing great detail in the higher pressure bracket. The action is fully automatic.

The Instrument is equipped with an automatic "stop" and "go" mechanism which sets it in operation by merely operating a lever so that the record begins on the chart the moment the cement job starts.

The Recorder is mounted in a steel box manifolded to an oil-filled, 6,000 lb. streamlined Indicating Gauge identical to those furnished with Martin-Decker Mud Pump Gauges.

The system is sealed at the Factory and equipped with adjustable Pulsation Damper and connected to a Martin-Decker alloy steel diaphragm protector by means of a high pressure steel reinforced flexible hose.

The instrument is designed for connection into the pump discharge manifold, with instrument panel mounted on the back of the cab or any convenient position desired by the operator.

M-D two pen Automatic Cement Pump Recorders can be furnished for pressures up to 15,000 lbs.

GREATER LEGIBILITY

The four-hour clock spreads the record out so that it is not crowded. Clear legibility and interpretation is further increased by the use of a chart-driving mechanism which turns faster than most recording devices and may be started and stopped at will by the operator. This device can be used for any type of pressure-recording information requiring great detail and wide range.

***Write* for complete information!**

HOME OF THE WEIGHT INDICATOR

MARTIN DECKER CORP.

LONG BEACH, CALIFORNIA

SAN JOAQUIN VALLEY: T. J. CULLEN, BAKERSFIELD, CALIFORNIA
MID-CONTINENT DISTRIBUTOR: REED ROLLER BIT COMPANY, HOUSTON, TEXAS

drilled in county. Information gained from the Lower Permian beds greatly influenced deep prospecting that began yielding spectacular results within a year.

LANGLIE-MATTIX

Discovery Data: Surface geology and trend. **Discovery Well:** Langlie Sector: Anderson-Prichard's (was R. H. Henderson) Langlie 1, C SE SE 8-25s-37e, July 22, 1935, oil discovery Leonard & Levers' Justis 1, C SE NE 19-25s-37e, Jal townsite June, 1931, gas discovery. Mattix Sector: Amon G. Carter et al's G. H. Mattix 1, C SE NW 3-24s-37e, July 19, 1935 **Type of Structure:** Anticline. **Producing Formations:** Langlie Sector: Seven Rivers 3165-3590 ft, average 133 ft penetration. Mattix Sector: Yates and Seven Rivers 3285-3770 ft, average 146 ft penetration. **Producing Area:** Oil: 14,400 acres. Gas: 1760 acres. **Production June 30, 1947:** Daily: 3806 bbls. Cumulative: 21,914,490 bbls. Estimated remaining reserves: 35,686,000 bbls. **Producing Wells June 30, 1947:** Total: 326 (flowing: 253; artificial lift: 73). Depleted: 18. Converted to gas: 16. Gas: active: 35; dormant: 9. **Gravity:** 36-40. **Rigs Running June 30, 1947:** 2. **Deepest Test:** El Paso Nat. Gas's Ginsberg 1, C SW NW 7-25s-38e, failure in Ordovician lime and chert at 11,014 ft. **Oil Outlets:** Shell, Texas-New Mexico, Humble. **Principal Leaseholders:** Amerada, Anderson-Prichard, Bridgeport Machine, Cities Service, Continental, Culbertson et al, Gulf, Humble, Phillips, Plains Prod., Repollo, Shell, Skelly, Stanolind, Sun, Sunray, Texas Co., Westates Pet., Western Gas Co. **Remarks:** The field has produced over 1500 bbls per acre. Total gas produced in excess of 200 million mcf. Only 15 wells currently capable of making their top allowable.

LEA

Discovery Data: Geology. **Discovery Well:** Texas Co. et al's Lea 1, SW SW NW 14-20s-34e, completed September 5, 1934. **Type of Structure:** Anticline. **Producing Formations:** Yates 3556-79 ft. **Producing Area:** 40 acres. **Production June 30, 1947:** Cumulative: 66,081 bbls. Estimated remaining reserves: Depleted. **Gravity:** 37-38. **Rigs Running June 30, 1947:** None. **Deepest Test:** Texas Co.'s Elliott 1, C SE SW 11-20s-34e, failure in Seven Rivers at 3861 ft. **Oil Outlets:** Texas-New Mexico. **Remarks:** Single well depletetd and plugged March, 1946.

LOVINGTON

Discovery Data: Geology. **Discovery Wells:** Westmount Oil Co.'s State-Amerada 1, C NW NE 12-17s-36e, completed December 5, 1938, dry gasser (shallow). Skelly's State 1-N, C NW NE 36-16s-36e, completed January 24, 1939, oil discovery. Stanolind's State 1-E, C SW SE 1-17s-36e, completed January 20, 1939, as gas pay discovery in big lime. **Type of Structure:** Anticline. **Producing Formations:** San Andres 4600-5110 ft, averaging 321 ft of broken lime penetration. Yates (gas) 3230-3319 ft. Big Lime 3891-3911 ft. **Producing Area:** Oil: 2200 acres. Gas: 80 acres. **Production June 30, 1947:** Daily: 1762 bbls. Cumulative: 4,351,993 bbls. Estimated remaining reserves: 13,248,000 bbls. **Producing Wells June 30, 1947:** Total: 53 (flowing: 30; artificial lift: 23). Depleted: 3. **Gravity:** 34-35. **Rigs Running June 30, 1947:** None. **Deepest Test:** Continental-Hersch-bach Drlg. Co.'s State 1-K, C SW SW 29-16s-37e, failure in dry San Andres 5303 ft. **Oil Outlets:** Texas-New Mexico. **Principal Leaseholders:** Amerada, Magnolia, Skelly, Tide Water, Barnsdall, Late Oil Co., Repollo, Stanolind, Fred Turner, United Producers, L. H. Wentz. **Remarks:** Half the wells have declined to marginal status. Development is about concluded for San Andres zone.

LOVINGTON WEST

Discovery Data: Geology. **Discovery Well:** Fred Turner, Jr. et al's State 1-B, C SE SW 4-17s-36e, completed June 14, 1944. **Type of Structure:** Anticline. **Producing Formations:** San Andres 4700-5183 ft, averaging 355 of penetration. **Producing Area:** 1760 acres. **Production June 30, 1947:** Daily: 1612 bbls. Cumulative: 1,425,013 bbls. Estimated remaining reserves: 12,655,000 bbls. **Producing Wells June 30, 1947:** Total: 44 (flowing 11; artificial lift: 33). **Gravity:** 36. **Rigs Running June 30, 1947:** 1. **Deepest Test:** Discovery plugged back from 5175 ft. **Oil Outlets:** Texas-New Mexico **Principal Leaseholders:** Humble, Magnolia, Phillips, Stanolind, Texas Co., Tide Water, Fred Turner, Jr., L. H. Wentz. **Remarks:** Only 5 wells are marginal producers. Nominal amount of development pending.

LUSK

Discovery Data: Geology. **Discovery Well:** Plains Prod. Co.-P. B. English's Jones 1, C SE NE 24-19s-31e, Eddy County, completed March 3, 1942. **Type of Structure:** Anticline. **Producing Formations:** Yates (Perm) 2450-2640 ft, averaging 13 ft of penetration. **Producing Area:** 240 acres. **Production June 30, 1947:** Daily: 59 bbls. Cumulative: 108,756 bbls. Estimated remaining reserves: 100,000 bbls. **Producing Wells June 30, 1947:** 4 pumping; 1 depleted. **Gravity:** 36. **Rigs Running June 30, 1947:** None. **Deepest Test:** P. B. English et al's Miller 1, C NE SE 18-19s-32e, failure in Queen at 4016 ft.. **Oil Outlets:** Texas-New Mexico. **Principal Leaseholders:** Plains Prod. Co., Carper Drlg. Co. **Remarks:** Only 1 producer in Lea County. Failures and small wells discourage further development.

LUSK EAST

Discovery Data: Geology. **Discovery Well:** Culbertson-Irwin-Southern Calif. Pet. Corp.'s Lynch-Texaco 1, C SW SW 21-19s-32e, completed January 24, 1942. **Type of Structure:** Anticline. **Producing Formations:** Yates 2622-2776 ft, averaging 20 of penetration. **Producing Area:** 240 acres. **Production June 30, 1947:** Cumulative: 89,402 bbls. Estimated remaining reserves: Depleted. **Gravity:** 23-24. **Deepest Test:** Discovery depleted and deepened to 3817 feet, then plugged. **Remarks:** Six producers drilled; field abandoned July, 1946

LYNCH

Discovery Data: Surface geology. **Discovery Well:** Texas Co.'s B. Lynch 1, NWc SE 34-20s-34e, March 21, 1929. **Type of Structure:** Anticline. **Producing Formations:** Yates and Seven Rivers 3719-95 ft, averaging 33 ft penetration. **Producing Area:** 480 acres. **Production June 30, 1947:** Daily: 281 bbls. Cumulative: 7,449,-578 bbls. Estimated remaining reserves: 2,-483,000 bbls. **Producing Wells June 30, 1947:** 9 pumping; 4 depleted. **Gravity:** 29-30. **Rigs Running June 30, 1947:** None. **Deepest Test:** Cranfill-Reynolds-Magnolia's State 1-D, 2286 ft snl and 2310 ft ewl 3-21s-33e, failure in Seven Rivers at 4046 ft. **Oil Outlets:** Texas-New Mexico. **Principal Leaseholders:** General Crude, Texas Co. **Remarks:** Yield has been 15,-500 barrels per acre, approximately 10 million barrels of water, to date. All production pumped, as no gas with oil or in area.

LYNCH NORTH

Discovery Data: Geology. **Discovery Well:** Cities Service's (was Henderson-Dexter et al) Jewett-McDonald 1, SE SE SE 18-20s-34e, completed June 12, 1929. **Type of Structure:** Anticline. **Producing Formations:** Yates and Seven Rivers 3350-3587 ft, broken pay. **Producing Area:** 40 acres. **Production June 30, 1947:** Daily: 14 bbls. Cumulative: 121,980 bbls. Estimated remaining reserves: Not important. **Producing Wells June 30, 1947:** 1 pumping. **Gravity:** 34-35. **Rigs Running June 30, 1947:** None. **Deepest Test:** Discovery plugged back from 3612 ft. **Oil Outlets:** Texas-N. M. **Principal Leaseholders:** Cities Service. **Remarks:** Failures confine to 1-well pool.

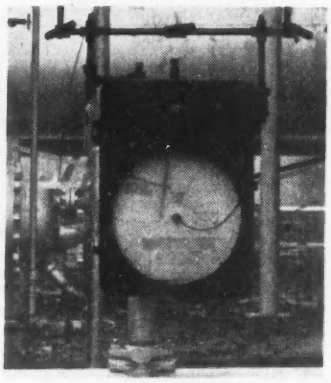
MALJAMAR

Discovery Data: Random drilling. **Discovery Wells:** Buffalo Oil Co.'s (was Maljamar O&G Corp.) Baish 1, NE NE NE 21-17s-32e, completed July, 1926, discovery well for county and in San Andres; ditto Baish 5, C SW NE 21-17s-32e, completed December 12, 1935, Queen pay (upper) oil discovery. Barney Cockburn's Westall-State 1, C NW NW 36-17s-32e, completed December 30, 1941, deep pay discovery. **Type of Structure:** Anticline. **Producing Formations:** Queen: 2330-68 ft, averaging 14 ft of penetration. Gas: 3100-3200 ft. Grayburg and San Andres: 3538-4270 ft, averaging 137 ft of penetration. Deep Pay: 4640-4733 ft (depleted). **Producing Area:** Oil: 10,240 acres Gas 80 acres. **Production June 30, 1947:** Daily: 6096 bbls. Cumulative: 14,593,784 bbls. Estimated remaining reserves: 57,086,000 bbls. **Producing Wells June 30, 1947:** Total Oil: 242 (flowing: 201; artificial lift: 41): Depleted: 2. Shut in: 12. Total Gas: 2 (flowing: 1; dormant: 1). **Gravity:** 36-39. **Rigs Running June 30, 1947:** 3. **Deepest Test:** Phillips' State-"Lea-Mex" 4, C SW SW 17-17s-33e, failure in unidentified shaley-lime at 13,998 ft. Deepest in state. **Oil Outlets:** Texas-New Mexico, Murchison & Closuit. **Principal Leaseholders:** Buffalo Oil Co., Carper Drlg. Co., Barney Cockburn, Johnny Cockburn, Drilling & Exploration, Emperor, Kewanee, Phillips. **Remarks:** This is first producing area in county; discovery used for gas-input well after producing 329,774 bbls. Development and production greatly retarded due to inadequate market outlet, which has been recently relieved. Repressuring underway on 6920 acres of field, including 173 producing and input wells. Oil recovery to date is in excess of 1400 bbls per acre average. Field has an unusually long flowing life.

MALJAMAR NORTH

Discovery Data: Geology. **Discovery Well:** Carper Drlg. Co.'s Taylor 1, SW SW SW 30-16s-32e, completed June 6, 1939, (depleted). Buffalo Oil Co, (was Maljamar) Mitchell 2, SW SE SW 5-17s-32e, completed September 1, 1939 as gasser, then converted to oil. **Type of Structure:** Anticline. **Producing Formations:** Grayburg (Perm) 3690-4050 ft, averaging 308 ft of broken pay. **Producing Area:** 160 acres. **Production June 30, 1947:** Daily: 16 bbls. Cumulative: 81,993 bbls. Estimated remaining reserves: Not important. **Producing Wells June 30, 1947:** 2 pumping; 2 depleted. **Gravity:** 36-39. **Rigs Running June 30, 1947:** None.

THEY FIT
THE MOST ADVANCED
PROCESSES



MANY thousands of American Meter Company's METRIC Orifice Meters, based on the famous Westcott Manometer, are in operation in oil fields and refineries around the globe. They are the choice of experienced instrument engineers wherever simplicity, rugged construction, and ease of adjustment and maintenance are of critical importance.

That's why METRIC Orifice Meters and measuring devices have an unsurpassed reputation for low-cost accuracy throughout the world.

Technical literature, giving complete data, will be mailed on request. Also information on the Round Case Flowmeters, Liquid Level and Flow Controllers.

AMERICAN METER COMPANY
INCORPORATED (ESTABLISHED 1836)
Albany • Atlanta • Baltimore • Birmingham • Boston
Chicago • Dallas • Denver • Erie • Houston • Joliet
Kansas City • Los Angeles • New York • Orlando
Philadelphia • Pittsburgh • San Francisco • Tulsa

New 24 story City National Bank building, where we will occupy our new home this month.

Oil and Gas Financing

Practical oil men, long associated with the industry and widely experienced in its financial requirements, are here to discuss your oil and gas financing. Located where the major part of the Nation's oil and gas activities are concentrated, we are in a position to approach your problems with a technical understanding that results in prompt action.

You are invited to discuss your financing with our oil and gas department.

THE City National BANK OF HOUSTON

MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION

Deepest Test: Maljamar's Mitchell 2, SW SE SW 5-17s-32e, plugged back from San Andres at 4498 ft. **Oil Outlets:** Murchison & Closuit P. L. Co. **Principal Leaseholders:** Suppes and Suppes. **Remarks:** Future development will be nominal.

MALJAMAR SOUTH

Discovery Data: Geology. **Discovery Well:** Buffalo Oil Co.'s (was Maljamar O&G Corp) D. C. Cheesman 2, 660 ft snl and 675 ft wel 22-18s-32e, completed July 31, 1943. **Type of Structure:** Anticline. **Producing Formations:** Grayburg and San Andres 4630-76 and 4771-90 ft. **Producing Area:** 80 acres. **Production June 30, 1947:** Daily: 15 bbls. Cumulative: 29,905 bbls. Estimated remaining reserves: Not important. **Producing Wells June 30, 1947:** 1 pumping; 1 depleted. **Gravity:** 33. **Rigs Running June 30, 1947:** None. **Deepest Test:** Discovery plugged back from San Andres at 4840 ft. **Oil Outlets:** Texas-New Mexico. **Principal Leaseholders:** Buffalo Oil Co. **Remarks:** Small pumping production and nearby failures discourage further development.

PADDOCK

Discovery Data: Geology. **Discovery Well:** Gulf's E. T. Paddock 1, C SW SE Sect. 1-22s-37e, completed April 7, 1945. **Type of Structure:** Anticline. **Producing Formations:** Glorietta (Paddock) 5051-5250 ft, averaging 43 ft of lime penetration. **Producing Area:** Oil: 3080 acres (surface). Gas: 40 acres. **Production June 30, 1947:** Daily: 3746 bbls. Cumulative: 1,249,839 bbls. Estimated remaining reserves: 17,230,000 bbls. **Producing Wells June 30, 1947:** Total Oil: 77 (flowing: 72; artificial lift: 5). Gas: 1 active. **Gravity:** 35.4-39. **Rigs Running June 30, 1947:** 2. **Deepest Test:** See Brunson field. **Oil Outlets:** Texas-New Mexico, Shell. **Principal Leaseholders:** Amerada, Cities Service, Gulf, Humble, Magnolia, Ohio, Shell, Skelly, N. G. Penrose, Rowan Drlg Co. **Remarks:** First oil production from Glorietta in Lea County. Equivalent to the Holt in West Texas, usually occurring on flank of structure. Preliminary reservoir pressure readings indicate rapid decline. This oil zone has been advanced west and northwest to the older Permian pay fields, and has induced multiple drilling.

PEARSALL

Discovery Data: Geology. **Discovery Well:** Phipps Oil Co.'s (was J. D. Barefield-J. B. Phipps) Walker 1, C SE NE 5-18s-32e, completed January 28, 1940. **Type of Structure:** Anticline. **Producing Formations:** Queen 3355 3610 ft, averaging 36 ft of penetration. **Producing Area:** 560 acres. **Production June 30, 1947:** Daily: 185 bbls. Cumulative: 480,560 bbls. Estimated remaining reserves: 1,199,000 bbls. **Producing Wells June 30, 1947:** Total: 14 (flowing: 5; artificial lift: 9). **Gravity:** 36-38. **Rigs Running June 30, 1947:** None. **Deepest Test:** See Maljamar. **Oil Outlets:** Texas-New Mexico. **Principal Leaseholders:** Brock and Freundlich, Kewanee Oil Co., Phipps Oil, Martin Yates, Jr., Fair Foundation, Allen. **Remarks:** Involves shallow pay sector on the south and southeast side of Maljamar field. Development about concluded.

PENROSE-SKELLY

Discovery Data: Geology and regional trend. **Discovery Well:** Penrose Sector: N. G. Penrose-Rowan-Nichols Oil Co.'s Cary 1, C NW SW 22-22s-37e, December 13, 1935. Skelly Sector: Skelly-Unit Members' B. F. Harrison 1, C NW SW 5-23s-37e, completed February 2, 1936. **Type of Structure:** Anticline. **Producing Formations:** Penrose Sector: Queen and Grayburg 3534-3890 ft, average 64 ft penetration. Skelly Sector: Queen and Grayburg 3479-3712 ft, average 116 ft penetration. **Producing Area:** Oil: 14,520 acres. Gas: 160 acres. **Production June 30, 1947:** Daily: 1666 bbls (total both areas). Cumulative: 17,446,161 bbls (both areas). Estimated remaining reserves: 26,105,000 bbls (both areas). **Producing Wells June 30, 1947:** Total Oil: 320 (flowing: 148; artificial lift: 172). Depleted, deepened or converted to gas: 43. Total gas: 4 (active: 1; dormant: 3). **Gravity:** 36-38. **Rigs Running June 30, 1947:** None. **Deepest Test:** See Brunson field. **Oil Outlets:** Shell, Texas-New Mexico. **Principal Leaseholders:** Amerada, Atlantic, Cities Service, Continental, Devonian, Elder & Willingham, Gulf, Humble, Magnolia, Ohio, Penrose, Neville, Repollo, Shell, Skelly, Stanolind, Sun, Tide Water. **Remarks:** Oil recovery to date has been 1200 bbls per acre. All but 1 oil well currently are marginal producers. Wells with large diameter oil strings will be deepened as they enter non-profitable stage to Glorietta, Yeso and pre-Permian oil zones, whenever these deeper producing zones are present.

RHODES

Discovery Data: Geology. **Discovery Well:** Texas Co. et al's W. H. Rhodes 1, SE NE NW 22-26s-37e, completed November 3, 1927. **Type of Structure:** Anticline. **Producing Formations:** Yates and Seven Rivers 3005-3415 ft, average 141 ft penetration. **Producing Area:** Oil: 2200 acres (scattered). Gas: 800 acres. **Production June 30, 1947:** Daily: 875 bbls. Cumulative: 3,145,744 bbls. Estimated remaining reserves: 7,854,000 bbls. **Producing Wells June 30, 1947:** Total Oil: 43 (flowing 40; artificial lift: 3). Total gas: 20 (active: 2; dormant: 18). **Gravity:** 31-40. **Rigs Running June 30, 1947:** None. **Deepest Test:** Midwest Ref. Co.'s Farnsworth 19, NW SW SW 14-26s-37e, failure at 3877 ft. **Oil Outlets:** Texas-New Mexico. **Principal Leaseholders:** Amerada, Anderson-Prichard, Krupp Flaherty, Ohio, Texas Co. **Remarks:** This is second oldest producing area in County. Discovery produced 163,094 bbls and depleted. Total of 55 wells produced oil, but 2 abandoned and 8 converted to gas. Long flowing life due to wide intervals between wells.

ROBERTS

Discovery Data: Geology. **Discovery Well:** C. T. McLaughlin & Co.-Cosden Pet.'s State-Shell 1-a, C NW NE Sect 7-17s-33e, completed September 2, 1943. **Type of Structure:** Anticline. **Producing Formations:** Grayburg 4180-4345 ft, average penetration 102 ft. **Producing Area:** 80 acres. **Production June 30, 1947:** Daily: 35 bbls. Cumulative: 53,743 bbls. Estimated remaining reserves: 426,000 bbls. **Producing Wells June 30, 1947:** 2 flowing. **Gravity:** 40. **Rigs Running June 30, 1947:** None. **Deepest Test:** C. T. McLaughlin-Cosden's State-Shell 3-A, C SW SE 6-17s-33e, failure in San Andres at 4660 ft. **Oil Outlets:** New Mexico Asphalt and Ref. **Principal Leaseholders:** C. T. McLaughlin-Cosden. **Remarks:** More development pending; due to link with West Roberts field.

ROBERTS WEST

Discovery Data: Geology. **Discovery Well:** C. T. McLaughlin & Co.-Cosden's State-Phil 1, C. SE SW 2-17s-32e, completed September 17, 1945. **Type of Structure:** Anticline. **Producing Formations:** Grayburg and San Andres 3945-4385 ft, averaging 131 ft of penetration. **Producing Area:** 760 acres. **Production June 30, 1947:** Daily: 597 bbls. Cumulative: 210,296 bbls. Estimated remaining reserves: 4,350,000 bbls. **Producing Wells June 30, 1947:** Total: 19 (flowing: 17; artificial lift: 2). **Gravity:** 35.6-39.6. **Rigs Running June 30, 1947:** 2. **Deepest Test:** Discovery plugged back from 4419 ft in San Andres, topped at 4150 ft. **Oil Outlets:** Texas-New Mexico. **Principal Leaseholders:** McLaughlin & Cosden, Boller, Rutledge and Nichols, Ohio Oil, Phillips, Texas Co., Watson and Piner. **Remarks:** This area is in line for substantial enlargement.

SALT LAKE

Discovery Data: Subsurface geology. **Discovery Well:** Bay Pet. Corp.'s (was Harry W. Leonard and Van Welch) State 1, C NW NW 18-20s-33e, June 30, 1941. **Type of Structure:**

Empire Trust Company

NEW YORK

Capital Funds . . . $8,673,859.19

Total Resources . . . $124,605,094.23

Directors

DEAN MATHEY
Chairman of the Board

HENRY C. BRUNIE
President

FRANK V. BALDWIN
Retired

NED G. BEGLE
Chairman, B.F.D. Co.

EVERETTE L. DeGOLYER
DeGolyer & MacNaughton
Dallas, Texas

GEORGE A. EASLEY
Vice President, Salt Dome Oil Corp

DEAN S. EDMONDS
Pennie, Edmonds, Morton & Barrows

CHARLES S. GARLAND
Alex, Brown & Sons
Baltimore, Maryland

ARCHIBALD A. GULICK
Alexander & Green

PAUL H. HUDSON
Executive Vice President and Secretary

GRAHAM D. MATTISON
Dominick & Dominick, New Yark

DONALD H. McLAUGHLIN
President, Homestake Mining Co.

JULIAN S. MYRICK
Vice President
Mutual Life Insurance Co.

ARTHUR A. SEELIGSON
President, Transwestern Royalty Co.
San Antonio, Texas

JAMES H. VAN ALEN
Vice President, Farrar, Straus and Co., Inc.

Specialized experience is available for study and suggestions as to sound financing of oil properties.

Main Office
120 BROADWAY, NEW YORK

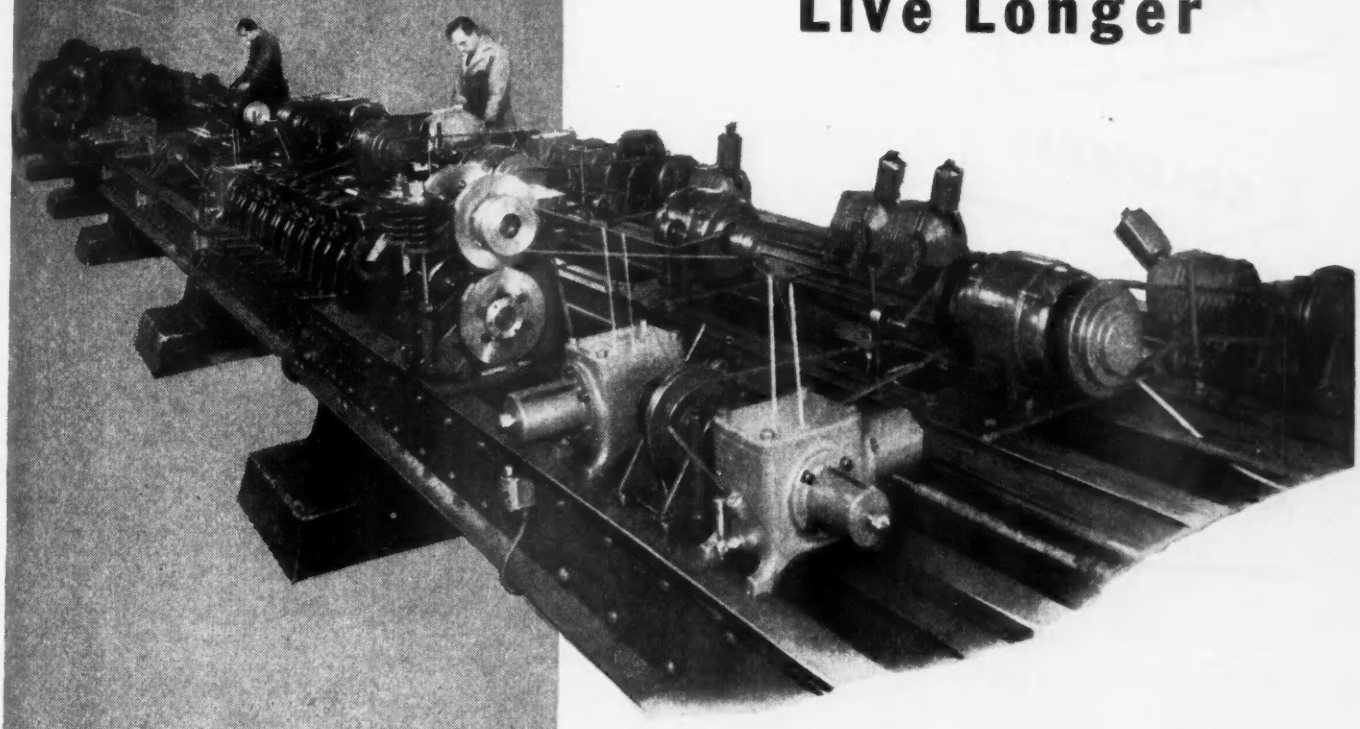
Empire Trust Company New York

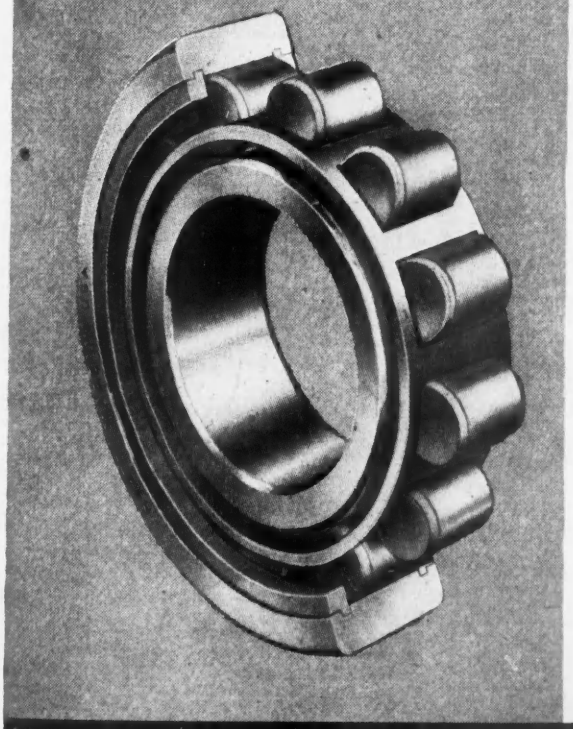
Fifth Avenue Office
580 FIFTH AVENUE

MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION

A DESTRUCTION LINE

...That Helps Bearings Live Longer





Supplementing the many eagle-eyed process inspections that each Hyatt Roller Bearing receives—beginning with raw material and following through every manufacturing operation—is our Destruction Line, pictured above.

Here bearings picked at random from the production line are placed in testing rigs which scientifically emulate the actual operating conditions of the bearings. They are kept running to the point of destruction.

Thus we can see ahead through the years what is expected of the bearings for the job they are designed to do. This pre-determined quality—plus such Hyatt features as inter-changeability of parts, to facilitate assembly; and maximum capacity for a given space permitting more efficient product design—combine to make Hyatt *first choice* of experienced designers. Years of care-free application have proved the wisdom of their choice. Hyatt Bearings Division, General Motors Corporation, Harrison, New Jersey.

HYATT ROLLER BEARINGS

Anticline. **Producing Formations:** Yates 2967-3110 ft, averaging 54 ft of penetration. **Producing Area:** 440 acres. **Production June 30, 1947:** Daily: 50 bbls. Cumulative: 281,440 bbls. Estimated remaining reserves: 100,000 bbls. **Producing Wells June 30, 1947:** 10 pumping; 1 dormant. **Gravity:** 26-30. **Rigs Running June 30, 1947:** None. **Deepest Test:** Marland Oil Co.'s Brooks 1, NW NW SW 8-20s-33e, failure at 4003 ft in Seven Rivers. **Oil Outlets:** Texas-New Mexico. **Principal Leaseholders:** Continental, Bay Pet. **Remarks:** All wells have declined to stripper basis. No further development of regular pay.

SAN SIMON

Discovery Data: Geology. **Discovery Well:** Skelly's State 1-U, C NE NE 5-22s-35e, November 28, 1943. **Type of Structure:** Anticline. **Producing Formations:** Yates sand 3985-4130 ft average 123 ft penetration. **Producing Area:** 80 acres. **Production June 30, 1947:** Daily: 14 bbls. Cumulative: 30,088 bbls. Estimated remaining reserves: Not important. **Producing Wells June 30, 1947:** 2 pumping. **Gravity:** 37-38. **Rigs Running June 30, 1947:** None. **Deepest Test:** Discovery plugged back from water in Yates at 4183 ft. **Oil Outlets:** Texas-New Mexico. **Principal Leaseholders:** Skelly. **Remarks:** Subnormal crude yield and nearby failures discourage further development of regular pay.

SAWYER

Discovery Data: Geology. **Discovery Well:** Devonian Oil Co.'s Browne-Federal 1, 660 ft snl and 580 ft ewl 19-9s-38e, completed February 14, 1947. **Type of Structure:** Anticline. **Producing Formations:** San Andres at 4926-5011 ft, involving 85 ft of broken lime pay. **Producing Area:** 40 acres. **Production June 30, 1947:** Daily: 39 bbls. Cumulative: new pool. Estimated remaining reserves: Undetermined. **Producing Wells June 30, 1947:** 1 flowing. **Gravity:** 25:4. **Rigs Running June 30, 1947:** None. **Deepest Test:** Ohio Oil's State-McCormick 1, C NE NE 36-9s-37e, failure in Glorietta 5651-58 ft, plugged back and headed oil briefly after acidizing San Andres, then plugged. **Oil Outlets:** Trucks to Levelland, Texas. **Principal Leaseholders:** Discoverer. **Remarks:** This discovery is 17 miles northwest of nearest production. Large producing area probable due to oil showings passed up by outlying failures at slightly lower structural position.

SKAGGS

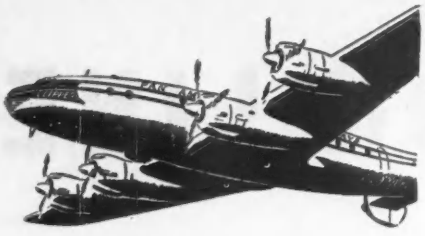
Discovery Data: Subsurface geology and geophysics. **Discovery Well:** Continental et al's Skaggs 1, C NE SE 24-20s-37e, completed March 26, 1937, oil discovery. DeKalb Agricultural Assn.'s Stovall-Magnolia 1, C NE SW 8-20s-38e, completed July 20, 1944, gas pay discovery. **Type of Structure:** Anticline. **Producing Formations:** Oil: San Andres 3750-3889 ft, averaging 105 ft of penetration. Gas: Yates sand 3150-3200 ft, involving 50 ft broken sd. **Producing Area:** 120 acres (oil); 40 acres (gas). **Production June 30, 1947:** Daily: 55 bbls. Cumulative: 237,362 bbls. Estimated remaining reserves: 483,000 bbls. **Producing Wells June 30, 1947:** Total: 3 (flowing: 2; artificial lift: 1). **Gravity:** 35. **Rigs Running June 30, 1947:** None. **Deepest Test:** DeKalb Agricultural Assn.'s Stovall-Magnolia 1, C NE SW 8-20s-38e, 7955 ft, lower Permian, pb for gas. **Oil Outlets:** Atlantic, Shell. **Principal Leaseholders:** Continental et al. **Remarks:** No failure within 1 mile of the oil producers; more development to follow later; dry gas production available in Yates. Single and inactive gasser is 2 1/3 miles ne of oil production.

TONTO

Discovery Data: Geology. **Discovery Well:** Texas Co.'s Baskin 1, C SE SE 22-19s-33e, completed June 3, 1944. **Type of Structure:** reef. **Producing Formations:** Seven Rivers 3565-86 ft, involving 21 ft of penetration. **Producing Area:** 40 acres. **Production June 30, 1947:** Daily: 20 bbls. Cumulative 59,460 bbls. Estimated remaining reserves: Not important. **Producing Wells June 30, 1947:** 1 pumping. **Gravity:** 34. **Rigs Running June 30, 1947:** None. **Deepest Test:** Texas Co.'s Baskin 3, C SW SW 23-19s-33e, failure at 3692 ft. **Oil Outlets:** Texas-New Mexico. **Principal Leaseholders:** Texas Co. **Remarks:** Five failures in immediate area caused termination of development.

VACUUM

Discovery Data: Torsion balance reconnaissance combined with surface geology. **Discovery Well:** Magnolia's (was Vacuum Oil Co.) State 1, C of w line 13-17s-34e, July, 1929. Repollo Oil Co.'s State 1-197, SE SE SE 6-17s-34e, completed June 28, 1938, as discovery of NW Vacuum sector, being 3½ miles from main field. **Type of Structure:** Anticline. **Producing Formations:** Grayburg and San Andres 4117-4860 ft, averaging 233 ft of penetration. **Producing Area:** 14,520 acres. **Production June 30, 1947:** Daily: 10,651 bbls. Cumulative: 37,044,746 bbls. Estimated remaining reserves: 79,115,000 bbls. **Producing Wells June 30, 1947:** Total: 358 (flowing: 194; artificial lift: 164). Depleted 5. **Gravity:** 35-36. **Rigs Running June 30, 1947:** 2. **Deepest Test:** Texas Co.'s State 1-A-E, C NW NW 12-18s-34e, plugged back from 5194 ft. **Oil Outlets:** Texas-New Mexico, Magnolia.



MEXICO

COLOMBIA

VENEZUELA

the NEAR EAST

. . . and other leading oil centers throughout the world are on the routes of the Flying Clippers

Today, going by Clipper, you can be at distant oil fields in a matter of hours.

Or you can speed essential machine parts and other needed materials there by swift, sure, time-saving Clipper Express!

When you fly by Pan American, you travel with a world-wide transportation system which has logged over half-a-billion overseas miles, a record unequalled by any other airline.

● For reservations, please see your Travel Agent or the nearest Pan American office.

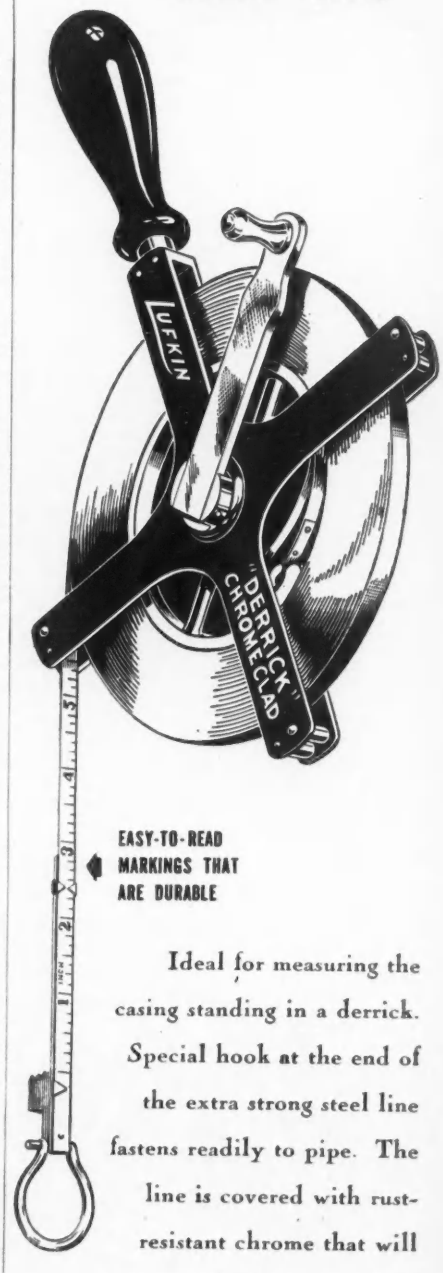
● For Clipper Express, call Railway Express Agency, Inc.

WORLD'S MOST EXPERIENCED AIRLINE

PAN AMERICAN WORLD AIRWAYS

The System of the Flying Clippers

LUFKIN "DERRICK" CHROME CLAD STEEL TAPE



EASY-TO-READ MARKINGS THAT ARE DURABLE

Ideal for measuring the casing standing in a derrick. Special hook at the end of the extra strong steel line fastens readily to pipe. The line is covered with rust-resistant chrome that will not crack, chip, or peel — easy-to-read jet black markings won't wear off. Order through your supply house.

Write for free catalog.

LUFKIN

THE LUFKIN RULE CO.,

SAGINAW, MICHIGAN, New York City

DIRECTORS

H. Lutcher Brown,
Pres., Brown Paper Co., Monroe, La.
Henry H. Bryant,
Pres., San Antonio Buick Co.
John Catto, Jr.,
Insurance
J. H. Frost,
President
T. C. Frost,
Vice-President
J. H. Frost, Jr.,
Vice-President
Lytle W. Gosling,
Pres., Lytle W. Gosling & Co.
Gus J. Groos,
Partner, E. B. Chandler & Co.
H. L. Kokernot
Cattleman
J. H. Lapham,
Director, The Texas Co.
Ned McIlhenny,
Vice-President
Marrs McLean,
Oil Producer
Dick Prassel,
Prassel Sash & Door Co.
Chas. Schreiner,
Capitalist and Cattleman
L. A. Schreiner,
Pres., Chas. Schreiner Bank, Kerrville, Texas
S. S. Searcy,
Attorney at Law

In Southwest Texas...

. . . that great, busy and prosperous section of the State, Frost National stands as the friendly bank with strong resources and able staff, offering complete service in all phases of oil operations.

This Bank, appreciating the importance of the oil industry and understanding its many problems, has on its Board of Directors several members active in this industry.

We'll be glad to serve you and feel that you will appreciate your banking relations the "Safety, Courtesy, Promptness" way.

Total Resources over $126,000,000

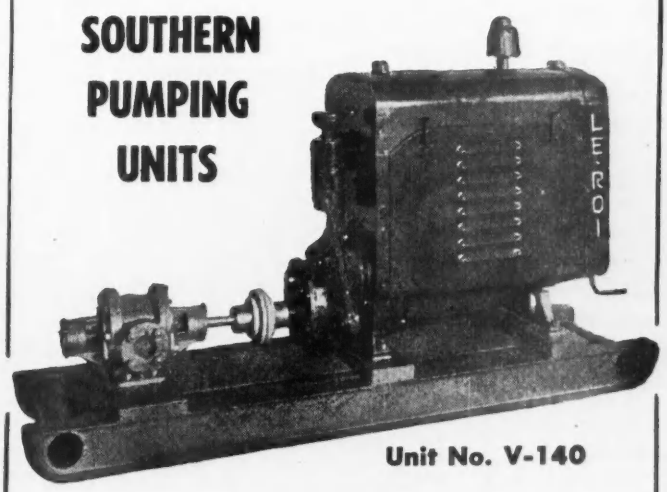
FROST NATIONAL BANK

OF SAN ANTONIO, TEXAS

SAFETY • COURTESY • PROMPTNESS

MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION

SOUTHERN PUMPING UNITS



Unit No. V-140

Le Roi Power Unit — Viking Pump. Capacity 140 barrels per hour.

Complete units and replacements in Houston and Kilgore stocks.

SOUTHERN ENGINE & PUMP COMPANY

MANUFACTURERS • MACHINERY FACTORS • CONTRACTORS
Houston - Dallas - Kilgore - San Antonio - Edinburg

"I'll take the WHITE one every time!"

WYTEFACE "A"
Trade Mark
Steel Tapes for the Oil Industry

WYTEFACE "A" Steel Tapes have raised black graduations on a crack-proof white surface. Easy to read in any light, from any angle. Designed for hard service. Resist rust and corrosion. Raised rims and markings protect the white background from abrasion from rails, pipe, rocks, concrete. Made in styles especially for Oil Riggers, Oil Gaugers and for general measurements. See your supply house, or write for details to Keuffel & Esser Co., Hoboken, New Jersey.

KEUFFEL & ESSER CO.
EST. 1867
NEW YORK • HOBOKEN, N. J.
Chicago • Detroit • Los Angeles
St. Louis • San Francisco • Montreal

K+E
Drafting, Reproduction, Surveying Equipment and Materials, Slide Rules, Measuring Tapes.

A Copper Penny Commands 17 Six-Penny Common Nails . . .

This is the approximate across-the-counter price. To allow for adequate retail and wholesale margins, transportation and keg costs, the manufacturer must produce twice this many nails for a penny. Nails have always been either a close-margin or loss item in steel-making. A penny buys only a few less nails than heretofore.

The average price of steel as obtained by the mills is a little over 3c per pound — about $60 per ton (based on weighted production of 9 major steel items, representing a substantial percentage of steel production in the United States). Including the last increases, steel has advanced only about ½c per pound over the last ten years.

Nails are one of the steel products which require many reducing and finishing operations, consequently are higher per pound than the composite price of steel. Even so, today's price of nails adds only about $15 to the cost of building an average house as against the price of nails 10 years ago. ***Steel IS Cheap.***

SHEFFIELD STEEL

SHEFFIELD STEEL CORPORATION

HOUSTON KANSAS CITY TULSA

Carbon & Alloy Steel, Ingots, Blooms, Billets, Plates, Sheets, Merchant Bars, Steel Joists, Structural Shapes, Road Guard Reinforcing Bars

Welded Wire Mesh, Wire Products, Wire Rods, Fence, Spring Wire, Nails, Rivets, Grinding Media, Forgings, Track Spikes, Bolt & Nut Products

SALES OFFICES: Chicago, Ill.; St. Louis, Mo.; Des Moines, Ia.; Wichita, Kans.; Denver, Colo.; Oklahoma City, Okla.; Dallas, Tex.; San Antonio, Tex.; New Orleans, La.

Principal Leaseholders: Magnolia, Phillips, Texas Co., Shell, Standard of Texas, Ohio Oil, Humble, Pacific Western. **Remarks:** Field has produced slightly over 2500 bbls per acre. About half of wells are marginal producers. Considerable development pending on the west side of the structure, which has not been defined. The northwest extension well has produced 76,296 bbls.

WATKINS

Discovery Data: Geology. **Discovery Well:** W. H. Peckham et al's (was T. B. Brown-Olen F. Featherstone) Watkins 1, C SW SE 31-18s-32e, completed December 29, 1945. **Type of Structure:** Anticline. **Producing Formations:** Permian sandy lime from 3566-3608 ft. **Producing Area:** 40 acres. **Production June 30, 1947.** Daily: 12 bbls. Cumulative: 991 bbls. Estimated remaining reserves: Not important. **Producing Wells June 30, 1947:** 1 flowing. **Gravity:** 35. **Rigs Running June 30, 1947:** None. **Deepest Test:** Discovery plugged back from 4180 ft in San Andres. **Oil Outlets:** New Mexico Asphalt & Ref. Co. **Principal Leaseholders:** Peckham and Clark. **Remarks:** Small yield of discovery has discourage further development.

WEIR

Discovery Data: Geology: **Discovery Well:** Continental et al's J. M. Skaggs 4-B-23, C SW SE 23-20s-37e, se offset to 7700-ft production, completed May 20, 1946. **Type of Structure:** Anticline. **Producing Formations:** Clear Fork (Yeso) Lime 6760-6837 ft, average 77 ft penetration. **Producing Area:** 40 acres. **Production June 30, 1947:** Daily: 70 bbls. Cumulative: 25 289 bbls. Estimated remaining reserves: 215.000 bbls. **Producing Wells June 30, 1947:** 1 flowing. **Gravity:** 37. **Rigs Running June 30, 1947:** None. **Deepest Test:** See Cass pool. **Oil Outlets:** Atlantic. **Principal Leaseholders:** Continental et al. **Remarks:** Deeper production in same area classified as Cass field. More productive Yeso may be developed elsewhere on structure.

YOUNG

Discovery Data: Geology. **Discovery Well:** E. J. McCurdy, Jr.-McElroy Rch. Co.'s State-Young 1, C NE NW 20-18s-32e, completed February 14, 1945. **Type of Structure:** Anticline. **Producing Formations:** Queen 3741-94 ft, averaging 28 ft of sand penetration. **Producing Area:** 160 acres. **Production June 30, 1947:** Daily: 156 bbls. Cumulative: 72.370 bbls. Estimated remaining reserves: 728.000 bbls. **Producing Wells June 30, 1947:** Total: 4 (flowing: 3; artificial lift: 1). **Gravity:** 37-38. **Rigs Running June 30, 1947:** None. **Deepest Test:** E. J. McCurdy et al's Barton 1, C NE NE 29-18s-32e, failure in San Andres at 4648 ft. **Oil Outlets:** Texas-New Mexico. **Principal Leaseholders:** E. J. McCurdy, Jr.-McElroy Ranch Co. **Remarks:** Nominal volume of development pending in immediate area.

Insert Map

Accompanying this issue is an insert oil and gas map of the West Texas and New Mexico Permian Basin area. Additional copies, exactly as the maps accompanying this issue, are available from Commercial Drafting Service, 1615 Colquitt Street, Houston 6.

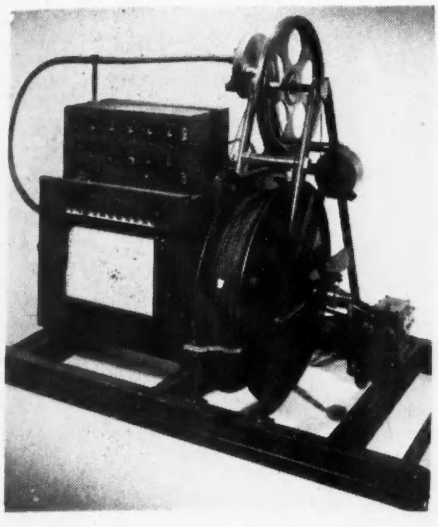
This map has been reproduced from a larger scale and bigger area copyrighted map compiled by Commercial Drafting Service. The original map extends from Brownwood to El Paso and from the top of the Panhandle to just north of Laredo, and is hand colored. The scale is one inch equals approximately 10 miles. It shows more than 550 oil, gas and condensate fields, size and ownership of oil and gas trunk pipe lines, refineries, natural gasoline plants, cycling plants and carbon black plants. Name and depth of producing formations, ownership and capacity of refineries and natural gasoline plants, and other data are shown in tabular form around the edges of the map.

A similar hand-colored map on the same scale which extends from the Mexican border to Mobile, Ala., along the Gulf Coast also is available from Commercial Drafting Service.

NEW EQUIPMENT and Literature

1—Portable Well Logging Unit

Filling the need for an easy-to-operate unit for seismograph shot holes, water wells, core holes, etc., of less than 2500 feet is a self-contained portable electric well logging device. The logging unit is



compact, measuring only 48 x 24 x 36 inches, while the power unit measures 16 x 10 x 17 inches. If the rig electrical system is 60 cycles, 110 volts, the power unit is not required. Weight of the logging unit is approximately 150 pounds, depending on the length of cable required. The power unit weighs 80 pounds.

No other auxiliary equipment is said to be required with the operation of the portable electric logging unit. Manufacturers state that it is easy to operate and that no technical knowledge of electrical logging is required to obtain accurate logs. Cable is lowered and raised at the rate of 3000 to 4000 feet per hour by an electrically-driven motor. In setting up, only one connection need be made, and this is the power plug which fits into the power unit or into the rig electrical system. By placing the logging unit on the rotary table or on the ground directly over the well, no bracing or guying is necessary. In both cases, the pull would be vertical.

Accurate readings are said to be obtained by continuous balancing "null-balance" measuring circuits which furnish precision measurements of electrical values. A standard cell is supplied with each unit and can be switched into the circuit at any time to verify the calibration. A positive drive from accurately-ground measuring sheave to chart insures correct depth readings. Potential scales furnished on standard equipment are 10, 20 and 50 millivolts per inch of lateral deflection; single point resistance scales are 2.5, 5, 10, 25, 50 and 100 ohms per inch of lateral deflection. Vertical scales are 5, 20, 50, and 100 feet per inch. Other scales can be provided if desired.

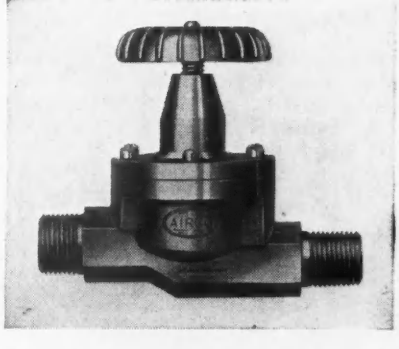
For further information write Hubert Guyod, Well Instrument Developing Company, First National Bank Building, Houston 2.

2—Station Outlet Valve

A product of Airco research and development, the new ½-inch station outlet valve is a compact combined shut-off and check valve for use on drops or risers in piping systems. The valve is a diaphragm type, and being "packless" has no stuffing box. Performing a dual function, the new station outlet valve eliminates the necessity of installing a separate shut-off valve and check valve.

As a shutoff valve it permits repairs or alterations to be made on equipment downstream from the valve without disturbing other stations on the line; as a check valve, it allows the flow of gas in only one direction and it will close tightly should a disturbance at the torch cause a back-pressure to travel as far as the valve.

Other distinctive features of the valve: compact and of simple construction; being a diaphragm type valve, no

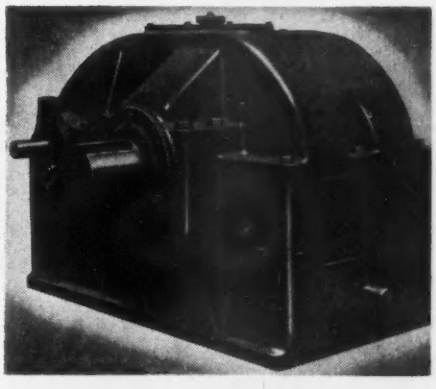


stuffing box or packing is required, thus eliminating possible leaks; body, bonnet and handwheel are brass forgings; several outlets can be connected to one service drop, each outlet being entirely independent of the other; it can be dismantled and reassembled easily and quickly. As an additional safety and economy measure, the manufacturer recommends that a plug and chain assembly be purchased with each station outlet valve. The new valves are immediately available.

For additional information write Air Reduction Sales Company, 60 East 42nd Street, New York 17, N. Y. or the nearest Airco sales office.

3—Speed Reducers

A new series of speed reducers designed specifically for oil field service replaces former designs but retains the best features which have been proven in more than 20 years of service. Nine sizes now in production were designed in accordance with the combined recommendations of the American Gear Manufacturers Association and the API for



standardized reducer ratings. They are as follows: OFD 25, OFD 40, OFD 57, OFD 80, OFD 114, OFD 160, OFD 228, OFD 320 and OFD 456. The numerical designation indicates the number of thousand inch-pounds of torque at which the reducer is rated at 20 strokes per minute.

Features of the new OFD series, 80 to 456 inclusive: (1) Precision generated, heat treated, herringbone gears for durability and long life; (2) all pinion shafts of alloy steel, heat treated, machined and ground to precision fits; (3) oil and dust proof housing with large oil reservoir, rugged construction for oil field service; (4) positive continuous lubrication to each bearing. Gears run in oil bath; (5) heavy-duty roller bearings throughout; (6) compact, symmetrical design; (7) extra heavy crankshafts and bearing support for rigidity.

Flush lubrication of all bearings assures their cleanliness and efficient operation. The gears rotate in a bath of oil. Oil is positively lifted from the case reservoir by special pockets in the low-speed gears and directed through the low-speed and intermediate bearings in a continuous stream. The high-speed bearings are flood-lubricated with oil from the high-speed pinion mesh. Return drains are provided at the outer end of each bearing so that oil can flow through the bearings freely back to the oil sump. Specially designed oil grooving prevents the lubricant from leaving the gear case along the shafts and keeps out the dust and weather.

The main shaft, or crankshaft, is designed basically to provide ample rigidity for the low speed gears and crank.

For additional information write Western Gear Works, P. O. Box 192, Lynwood, Calif.

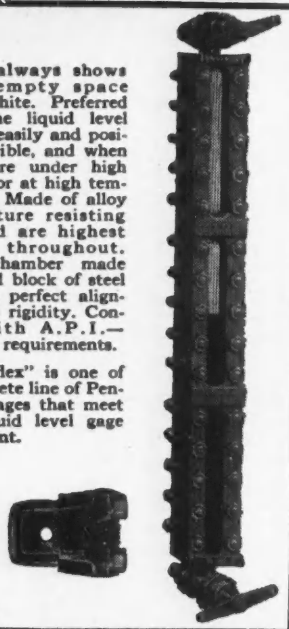
4—Single Joint Elevator

A single joint elevator for tailing in and laying down operations is based on the center latch design and incorporates a stirrup-type latch to insure positive closing. The elevator is furnished com-

PENBERTHY
"REFLEX"
DROP FORGED STEEL
LIQUID LEVEL GAGES

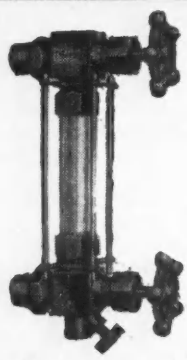
Liquid always shows black—empty space shows white. Preferred where the liquid level must be easily and positively visible, and when liquids are under high pressure or at high temperature. Made of alloy temperature resisting steel and are highest quality throughout. Liquid chamber made from solid block of steel to assure perfect alignment and rigidity. Conform with A.P.I.—A.S.M.E. requirements.

The "Reflex" is one of the complete line of Penberthy Gages that meet every liquid level gage requirement.



PENBERTHY INJECTOR CO.
DETROIT, MICH. Canadian Plant WINDSOR, ONTARIO

PENBERTHY
"ALL IRON"
LIQUID LEVEL GAGES

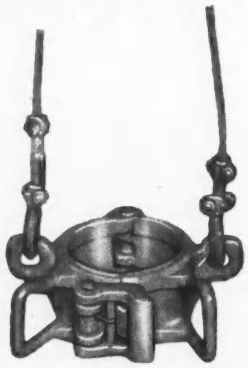


Body made from a special high strength alloy iron, shanks alloy steel and trim stainless steel. Extra heavy construction throughout, automatic and positive shut-off if glass breaks, heavy duty stuffing boxes. Conform with A.P.I.—A.S.M.E. requirements.

The "All Iron" is one of the complete line of Penberthy gages that meet every liquid level gage requirement.

PENBERTHY INJECTOR CO.
DETROIT, MICH. Canadian Plant WINDSOR, ONTARIO

plete with the wire line sling and the cat-line swivel, ready for use in the field. The use of this elevator for tailing operations is much safer than the rope sling so often used for this purpose. The



elevator also allows the pipe to be supported absolutely vertically and saves time in aligning the threads for spinning in. It also will save time and reduce accidents if used with drill pipe in making mouse-hole connections.

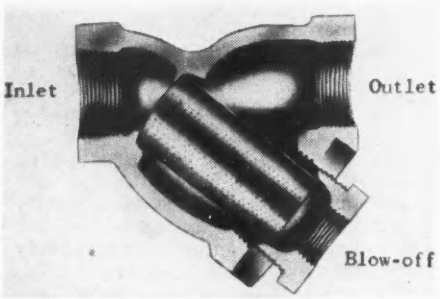
The elevator is available for all sizes of drill pipe or casing up to 13-inch. The weight ranges from 40 pounds for the smallest size to 55 pounds for the 13-inch size.

For additional information write Web Wilson Oil Tools, Inc., W. W. Wilson Bldg., Huntington Park, Calif.

5—Y-Type Strainer

A streamlined Y-Type Strainer for steam, air, gas, oil or water is claimed to largely overcome back pressure through a new arrangement of interior surfaces, guiding liquids or gases on a course unobstructed by sharp corners or abrupt changes in path of flow.

The manufacturer states that strain-



ers are self-cleaning by opening of blow-off cock, which flushes grit and dirt out of strainer by line pressure, without shutting off the line or removing the strainer elements. It is claimed that any one of several types of strainer elements regularly furnished with the strainer body will prevent fine particles of dirt and scale from passing into steam traps, pressure reducing valves and other sensitive line equipment. The free hole area of the screen element in the strainer body is from two to four times the area of the pipe connection, depending upon service for which the strainer is used and size of strainer.

These strainers are suitable for use on working steam pressures up to 250 pounds per square inch. and temperatures up to 450° F. For use on cold liquid lines or gas lines the pressure rating is 400 psi.

For additional information write Wright Austin Company, 315 West Woodbridge Street, Detroit 26

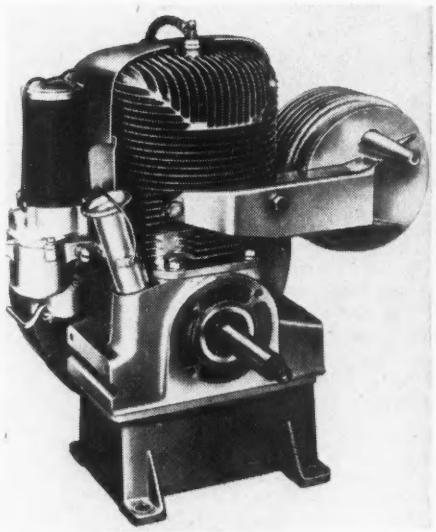
6—Lightweight Engines

New small, light-weight, two-cycle gasoline engines are being produced in four models which range from 2½ to four horsepower and which are designated Series 1200.

Three of these models are engines of a general-purpose type, adaptable to a variety of applications in the industrial, marine, aircraft, transportation, and other fields.

Basic advantages claimed for the new line of engines are: (1) light weight; (2) superior starting and idling characteristics; (3) compact size; (4) adaptability for additional applications; (5) simplicity.

The light weight of these engines, which is typified by the Model 1200C

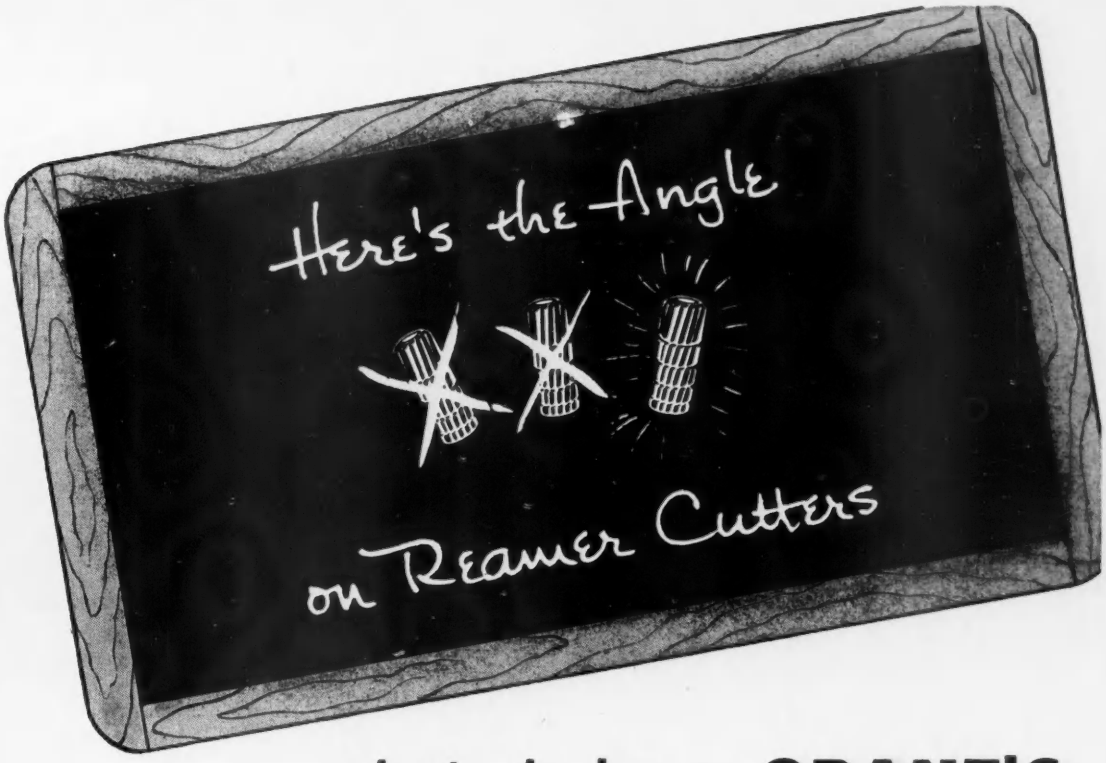


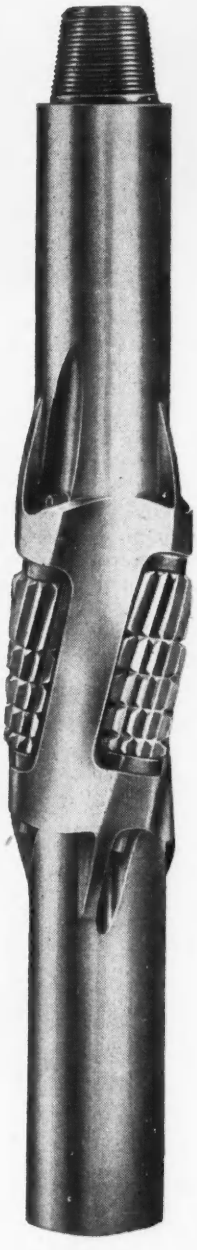
(24 pounds for four horsepower at 4000 revolutions per minute rated speed), is derived chiefly from the extensive use of aluminum-alloy die-castings.

The Model 1200C engine develops four horsepower at the rated speed of 4000 revolutions per minute, and weighs 24 pounds. It is air cooled. Standard equipment includes fan and cooling shroud. Displacement is 6.28 cubic inches, bore and stroke are 2 x 2 inches. A flywheel magneto provides ignition. Overall dimensions are height, 13.9 inches; length, 11.6 inches; width, 13.3 inches. It is started by rope, or by foot (a foot starter is optional equipment). An automatic clutch is also optional equipment.

The 1200C engine is equipped with a separator pressure oil system which eliminates need for mixing oil with gas. For specific applications, it can also be adapted for use with the McCulloch fuel injector or pressure carburetion.

For additional information write McCulloch Motors Corporation, Los Angeles.





GRANT
THREE-POINT REAMER

...that's the key to GRANT'S SHEARING-CUTTING ACTION!

In reaming, it's the *angle-of-set* of the reamer cutters than means straight, full-gauge reaming in any formation . . . that prevents cutter "tracking" . . . that keeps the reamer from threading itself into tight hole. *And in the Grant Reamer, you get the one tool with cutters set at the proper angle to give you most efficient "shearing-cutting" action!*

As they rotate in the hole, Grant Reamer cutters shear away formation with a cutting action that easily reams tight spots to gauge and insures round smooth hole all the way. Moreover, the angle-of-set of Grant cutters tends to push the tool upward--not downward—and thus avoids threading into tight spots in the hole.

FOOL-PROOF LOCK

Another important point is this: regardless of which "end up" you run when you put Grant Reamers in the hole, the lock that holds the cutters in position is so designed that cutters are securely held in the reamer body. Thus, by simply reversing cutters you can run in the hole with pin or box up — however you choose — without fear of losing the cutters. Streamlining of the reamer body provides greatest possible circulation clearance for faster reaming speeds and for free upward flow of mud and cuttings.

Grant Reamers are made in 3-point, 6-point and "near bit" types — in a complete range of sizes — and with cutter designs to meet *every* reaming and formation need. For more full-gauge hole, at lower reaming cost, specify the Grant Reamer on your next reaming job. *Get in touch with the Grant branch store nearest you today — or write direct for more details!*

Proven GRANT Tools
Used Where Performance Counts

Hydrostatic Bailers	Bulletin No. 11
Liner Pullers	Bulletin No. 14
Pressure Releases	Bulletin No. 15
Casing Scrapers	Bulletin No. 17
Wall Scrapers	Bulletin No. 20
Bottom Hole Scrapers	Bulletin No. 21
Under Reamers (Roller)	Bulletin No. 24
Under Reamers (Cable Tool)	Bulletin No. 27
Hole Enlargers	Bulletin No. 38
Reamers	Bulletin No. 43
Hydrostatic Perforation Cleaners	Bulletin No. 50
Dump Bailer	Bulletin No. 51
Roller Shale Bits	Bulletin No. 54
Sand Pumps	Bulletin No. 55
Impression Shoe Tool	Bulletin No. 56
Well Cleanout Equipment	Bulletin No. 57

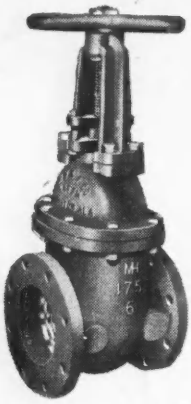
Write for Descriptive Bulletins on these GRANT Tools

GRANT OIL TOOL COMPANY

Main Office and Plant: 2042 East Vernon, Los Angeles 11, California

Branches at Bakersfield, Avenal and Ventura, California, and at Odessa and Houston, Texas

"Red Wheel"
VALVES, HYDRANTS
And Pipe Line Accessories



M & H valves are used in the oil industry for water, gas, steam, oil, chemicals and are furnished in all commercial sizes from 2" to 30", inclusive. They are cast iron body, bronze mounted, furnished double disc parallel seat or solid wedge. They are heavily proportioned and have a high factor of safety.

A. W. W. A. HYDRANTS
Underwriters Approved

Conform to American Water Works Association Specifications. Approved and listed by Underwriters' Laboratories and Associated Factory Mutuals. Well known and widely used for many years.

SPECIAL TRAFFIC MODEL is designed to yield at ground line under impact, repair being simply renewal of breakable bolts and breakable coupling on stem. High efficiency because barrel diameter not reduced and there are no working parts or obstructions in waterway.

OTHER M & H PRODUCTS

Fire Hydrants
Gate Valves
Tapping Valves
Special Castings
Tapping Sleeves
Check Valves
Floor Stands
Extension Stems
Mud Valves
Flap Valves
Sludge Shoes

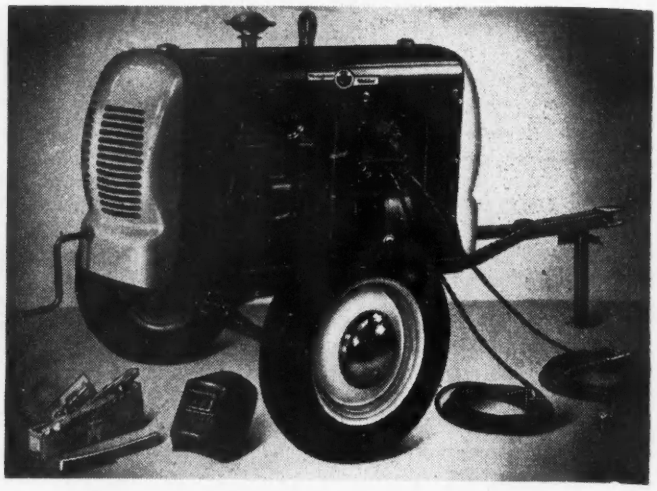
M&H VALVE
AND FITTINGS COMPANY
ANNISTON ALABAMA

NEW EQUIPMENT & LITERATURE

7—Portable Arc Welder

The new Flexarc lightweight engine-driven welder is designed for 200 amperes at 30 volts on the basis of 50 percent duty cycle. Each welder comes with accessories complete, including work and electrode leads, helmet, electrode holder, a liberal supply of electrodes and a wire scratch brush.

Dubbed "The Ranger," this DC welder can be towed anywhere a jeep can take it. The design characteristics of the generator provide easy striking and maintenance of the arc for shop quality welding on steel, cast iron, alloys, hard surfacing aluminum and brass.



The generator is direct-connected to a Hercules IXB engine. The welding current is adjusted over a wide range from 30 amperes at 20 volts to 250 amperes at 30 volts in four major steps by plugging screw locking plugs on work and electrode leads. Intermediate values of current are obtained by rheostat control. Polarity is positively controlled by interchanging work or electrode lead connections. Available either as a portable or stationary model.

For additional information write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30.

8—Automatic Mud Logger

The new model "B" Automatic Well Gas Detector automatically detects oil and gas formations as the well is being drilled by continuously analyzing the mud returns. The instrument indicates the volume of gas present in the mud at all times, thereby offering an additional safety factor for blowout prevention.

According to the manufacturer, the detector will measure the presence of gas in drilling mud at a ratio of greater than one part in 1 million.

The instrument is mounted on the end of the mud flow line, and the mud flow through the instrument drives the mechanism. The power supply for the unit is a two-volt battery. The instrument contains a balanced electrical bridge circuit which has a hot wire platinum filament in the lower part of the circuit. This filament is mounted in a chamber over which the gas vapors pass, causing combustion to occur around the filament. The electrical resistance of this filament changes, causing a current to flow in ratio to the amount of gas present in the mud, which is registered on the gas intensity meter. This meter is mounted on the derrick floor in view of the driller.

Other uses of this instrument: For approximating relative gas pressure base in sands to determine testing points, to establish the identity of unknown sands indicated on electrical log, and to indicate test points in thick sand for best potential.

The instrument is available for domestic use on a monthly rental basis and will be sold for export.

For additional information write Petroleum Instrument Company, 4601 Montrose Avenue, Houston.

9—Thermal Conductivity Unit

A new unit provides an accurate and inexpensive means of observing gases by the thermal conductivity method. Three important features of the Gow-

THE LAYNE
Wire Wrapped
SCREEN

Your Choice of 3 openings

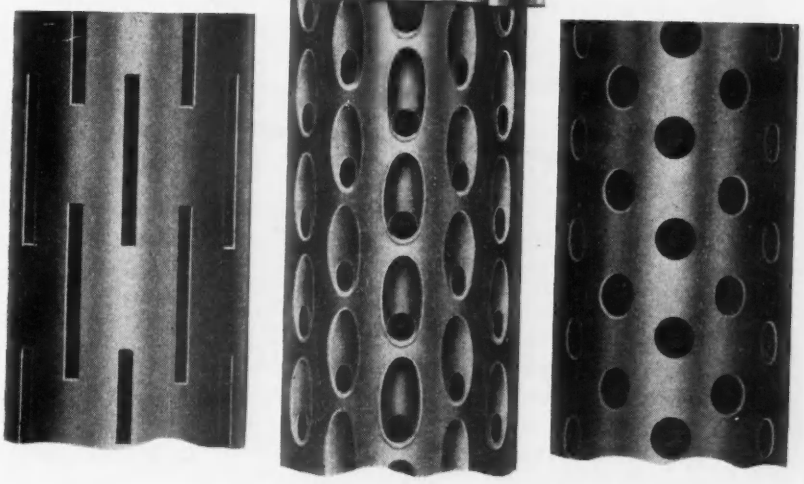
When you need a screen you need the best—and it should be especially adaptable to your particular sand problem.

In the Layne Screen you have the choice of three openings; milled groove, plain drilled, or slotted. Each has its place in the field.

Regardless of the opening desired, each Layne Screen is precision made with accurate and uniform openings between the wires—the lugs accurately sized.

Remember the Layne patented wire wrapped Screen has earned its leadership through performance.

Write for complete information.



Write for complete information.

THE LAYNE AND BOWLER COMPANY

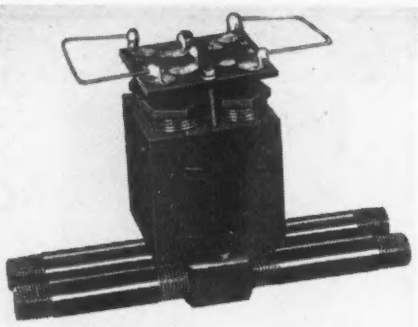
EXPORT:
E. H. (Gene) Trammell
Room 1636
30 Rockefeller Plaza
New York, N. Y.

General Office & Factory
8000 Market Street **Houston, Texas**

WEST COAST:
Layne & Bowler Corp.,
900 Santa Fe Ave.,
Los Angeles, Cal.

Mac unit are its low cost, its flexibility in gas train sampling, and the fact that no special instruments are required in using it. Standard instruments and accessories, as found in any laboratory, can be used with excellent results.

The Gow-Mac thermal conductivity unit incorporates four filaments assembled in appropriate chambers and wired in a balanced bridge arrangement. Each of the four elements conforms to predetermined standards of resistance. When used with a suitable source of constant voltage, the degree of unbalance of the bridge circuit provides an accurate measure of the relative thermal conductivity of an unknown gas or the quantitative variation in a known gas.



Typical applications include special atmospheres, gas synthesis, inert gas generation and distribution, efficiency of internal combustion engines and furnaces, and wherever hydrogen and carbon dioxide are found. Units may be used with indicating, recording or controlling instruments.

The unit is compact (1½ x 3½ x 2⅜ inches) and is relatively unaffected by vibration or ambient and current change. All parts are precision machined and there is no glass or cement to crack or flow and thus change characteristics. Each cell is tested at ten pounds per square inch prior to shipment.

For additional information write the Gow-Mac Instrument Company, 22 Lawrence Street, Newark 5, N. J.

10—Upside Down Packer

A new packer makes possible successful packing without cement. Called the Larkin Upside Down Packer, it was created to set in cap rock or hard formations in repressuring operations.

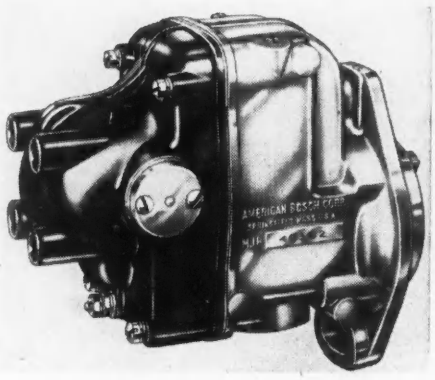
If formations in which the packer is set are impervious and of sufficient thickness, this packer may hold pressures in input wells without the use of cement. The new packer incorporates proved construction features.

An additional advantage provided by the Upside Down Packer is that it can be removed easily after the slip assembly is engaged. This is especially important in acidizing and washing operations on the face of input sand.

For additional information write Larkin and Company, Inc., Butler, Penn.

11—Magneto

The new MJH series of magnetos are especially designed for one, two, four and six-cylinder industrial engines of small and medium size. It combines rugged mechanical features and fine



electrical characteristics, employing an oil-impregnated stationary winding and an Alnico magnet rotor.

The one- and two-cylinder gearless types are equipped with ball bearings on the drive end of the rotor shaft, while those with gear-driven distributor rotors have ball bearings at both ends of the magnet rotor. The breaker assembly is removable as a unit, and once the contact points are aligned on the assembly, no further alignment is necessary after installation of the unit in the magneto.

MJH magnetos are available in vertical flange or base mounted types, with or without standard American Bosch ICA or ICB impulse couplings, and may be had in radio-shielded executions.

For additional information write American Bosch Corporation, Springfield 7, Mass.

FOR THE BEST IN CABLE TOOLS

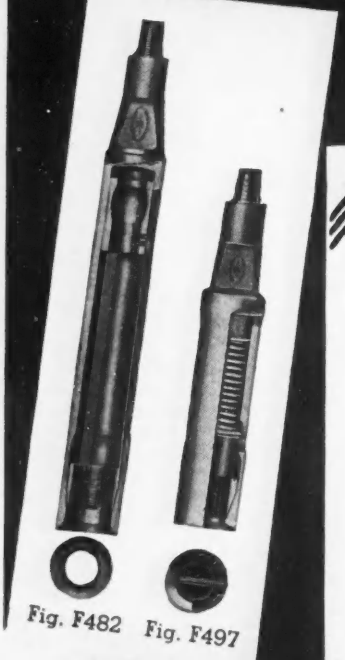


Fig. F482 Fig. F497

SPANG
FULL CIRCLE SLIP SOCKETS
(Fig. F482)
and
COMBINATION SOCKETS
(Fig. F497)

Spang Slip and Combination Sockets are rugged and tough. Room in the hole to add mass is limited, so Spang has substituted steel quality and heat treatment to give that extra strength needed to stand long heavy jarring when it is necessary.

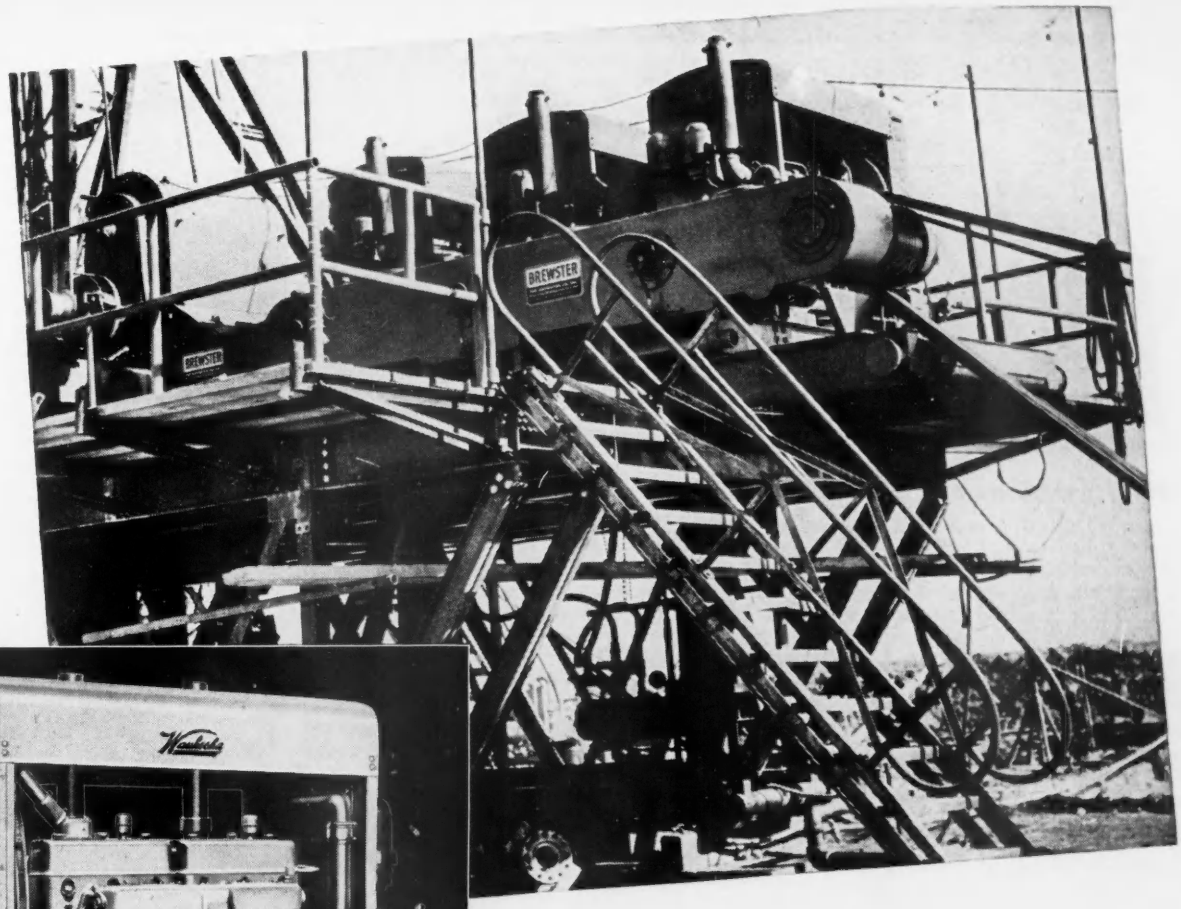
They are carefully forged, thoroughly heat treated, and accurately machined. You can count on them!

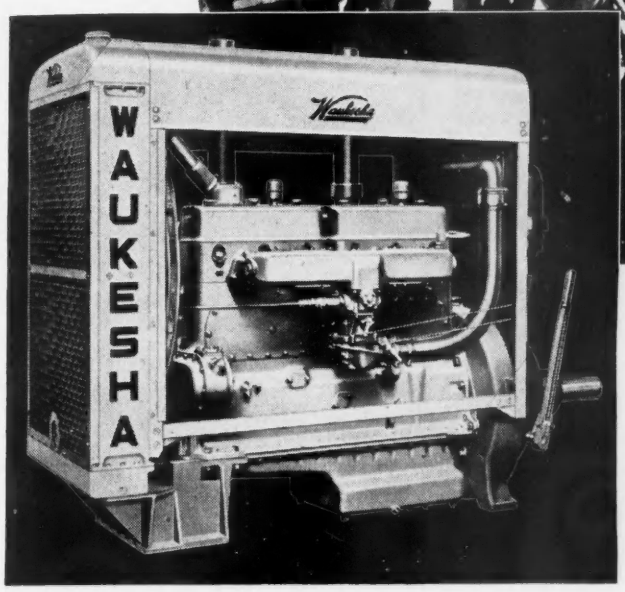
Even a soft, simple fishing job can get tough and complicated. That's why it pays to always use only the best fishing tools for any fishing job. For the best in Cable Tools, SPECIFY SPANG.

THE HIGHER STANDARD

SPANG & CO.
BUTLER, PA.

YOUR DEALER SELLS SPANG TOOLS





MODEL 6-WAKU WAUKESHA OIL FIELD POWER UNIT
6¼ in. x 6½ in., 1197 cu. in. displ. Burns gas or gasoline.

...get Super-duty DRILLING POWER from natural gas!

When it posed for the picture, this Brewster N-7 rig was making its first well, near Alice, Texas, for Selby-Walker Corp. Powered by three Model 6-WAKU Waukesha units, it put through 7500 ft. of hole in record time. Moved to an adjoining location, it went right to making more hole. These Waukeshas are *super-duty sizes*. Each one of 'em puts out better than 200 hp. at the peaks. And they do their work on natural gas. That's economy plus — as well as power plus — with deep drilling dependability. Rugged, too. From oil pan to head. Overhead valves, and removable wet-type cylinder sleeves, make maintenance easier as well as cheaper. Get Bulletin 1408.

WAUKESHA MOTOR CO., WAUKESHA, WIS., NEW YORK, TULSA, LOS ANGELES

WAUKESHA
OIL FIELD POWER

12—Work Launches

Made of durable steel with aluminum cabins, these work launches are said to withstand all kinds of punishment, and are capable of speeds of 22 miles per hour. Their overall length is 40 feet, 5 inches, with a deck beam of 12 feet, 8½ inches, and a light draft of 2 feet, 8 inches. Two types are being built, the single cabin and the sedan type. Although their specific jobs may be slightly different, the manufacturers claim they both will perform all the workhorse tasks of oil field work. They are powered with twin 200 horsepower engines. Total fuel capacity is approximately 370 gallons.

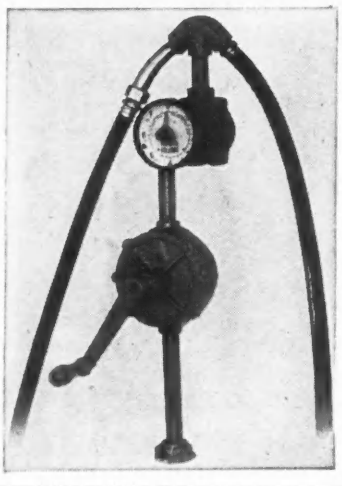
Avondale Marine Ways, Inc., Westwego, La.

13—Rotary Hand Pump

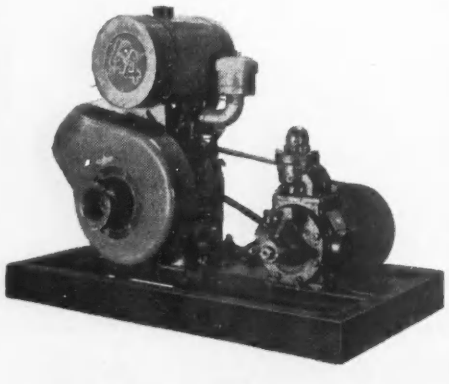
A meter-equipped rotary hand pump, Figure 3005, has been built for fueling or dispensing of liquids up to 10,000 Saybolt Second Units viscosity. The meter registers to 8 gallons and is equipped with a 9999 gallon totalizer. The unit includes a 40-inch suction pipe with bung attachment, eight-foot oil resistant discharge hose, and aluminum nozzle.

According to the makers, features of the 10 gallons per minute pump include an aluminum rotor, graphite-carbon vanes, cadmium plated packing nut and stainless steel springs.

For additional information write Bowser, Inc., Fort Wayne 2, Ind.



A Better...
TANK BOTTOM CIRCULATING UNIT



OIL EASIER TO TREAT—Oil passes through pump with minimum disturbance. No gears or high velocity impellers to churn and whip up tighter emulsions.

NO TIME "DOWN"—Replaceable Bucket-Type impellers and liners. Can be replaced in a few minutes.

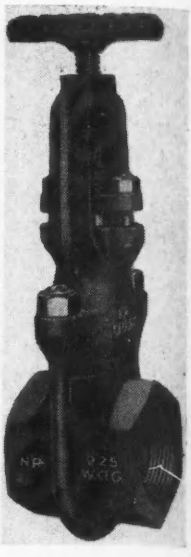
LOW OPERATING COST—Wearing parts easily and inexpensively replaced—pump need never be discarded.

Standard Units handle 27 and 50 Barrels per Hour. Larger sizes also available.

SOUTHWEST EQUIPMENT COMPANY
919 S. ERVAY DALLAS, TEXAS C-2291

14—Ni-Resist Gate Valve

Reinstatement of the Ni-Resist Cast Iron Gate Valves has been announced by Crane Company, which discontinued their manufacture prior to the past war. The valves are of the wedge disc, outside screw and yoke type and are being regularly furnished with screwed ends in sizes from ½ to two inches and with flanged ends in sizes from one to eight inches. All valves in sizes three inches and smaller have the clamp type bolted bonnet and sizes four- to eight-inch inclusive have the conventional type of bolted bonnet.



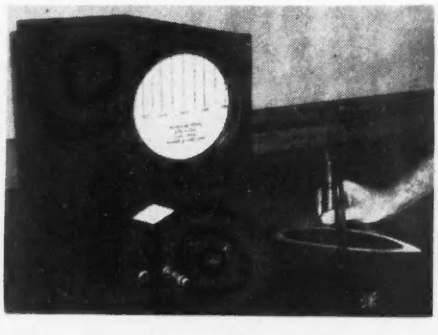
Body and bonnet of all valves, the disc in sizes four inches and larger, and the gland in sizes three-inch and smaller are made of Ni-Resist. The strength and physical characteristics of Ni-Resist are about the same as those of cast iron; but resistance to erosion and wear is definitely superior to that of cast iron, and corrosion resistance is substantially better.

To add to their corrosion resistance, the stem and body seat rings, the disc in sizes three-inch and smaller, and the disc facings in sizes four-inch and larger are made of Crane 18-8 alloy steel.

For additional information write the Crane Co., 836 S. Michigan Ave., Chicago.

15—Reflectogage

The Reflectogage, an instrument utilizing supersonics for thickness measurement and flaw detection, will supplement the Supersonic Reflectoscope and the Thruray. With the new instrument thickness of metals and other materials can be measured where access from only one side is available. Maximum error in



measurment, according to the manufacturers, is less than 2 percent of the thickness of the material.

Thickness of tubing and flat parts, between .005 and .300 inch, can be read directly from the face of the oscilloscope screen. Indirect reading of the thickness of parts up to four inches can be accomplished with slight calculation.

A quartz crystal searching unit is ap-

EXPERIENCE IN FOREIGN FIELDS

. . . . . pays off in profitable results when you contract with Independent

The success of almost any survey project in a foreign country depends on overcoming the varied special problems often encountered. Since 1932 Independent has had crews in Mexico and South America almost continuously, and has accumulated more than twenty crew-years of seismic survey experience in foreign fields.

The men who directed this work are at your service now to aid in planning your exploration program in any part of the world. Their experience and the record of results are your assurance of satisfactory returns on your investment.

You are cordially invited to consult with us about your plans.

Independent
EXPLORATION COMPANY
Geophysical Surveys

ESPERSON BUILDING **HOUSTON, TEXAS**

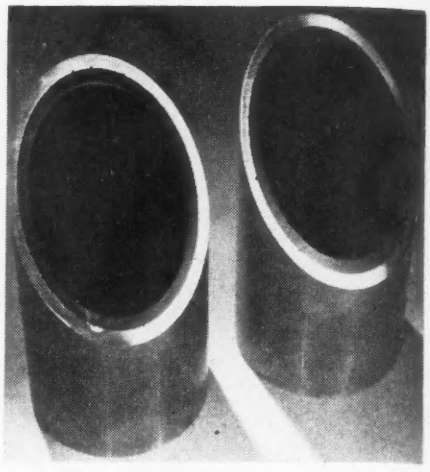
plied to the oiled surface of the material and the oscilloscope pattern observed by the operator. A vertical deflection of the oscilloscope trace will indicate resonance of the sound beam within the material. The position of the vertical deflection along the horizontal axis is determined by the resonant frequency and is thus related to thickness. When thin pieces are being tested, this thickness is read directly from the superimposed calibrated screen.

For additional information write Sperry Products, Inc., 15th Street and Willow Avenue, Hoboken, N. J.

16—Corrosion Resistant Pipe

Development of a new corrosion resistant pipe and pipe fittings was made by the plastics division of The Dow Chemical Company. Saran-lined steel pipe, designed to convey corrosive liquids, combines rigidity and pressure strength of steel pipe with Saran's extreme resistance to chemicals.

The new development is resistant to a very wide range of chemicals, oils and solvents. It is said to satisfactorily handle corrosive sulfuric, hydrochloric, nitric and phosphoric acids. Working temperature of the pipe ranges from zero to



190° F., depending upon the service conditions.

Pipe in maximum lengths of ten feet and in sizes from one to four inches in diameter will be manufactured. Fittings, also Saran-lined, include elbows and tees, companion and reducing flanges and gaskets. The latter are made of specially compounded Saran to assure maximum chemical resistance at joints.

Field assembly presents no undue problems. Conventional power tools may be used for cutting and threading and assembly of joints is very similar to that of standard steel piping, the company reports.

For additional information write The Dow Chemical Company, Midland, Mich.

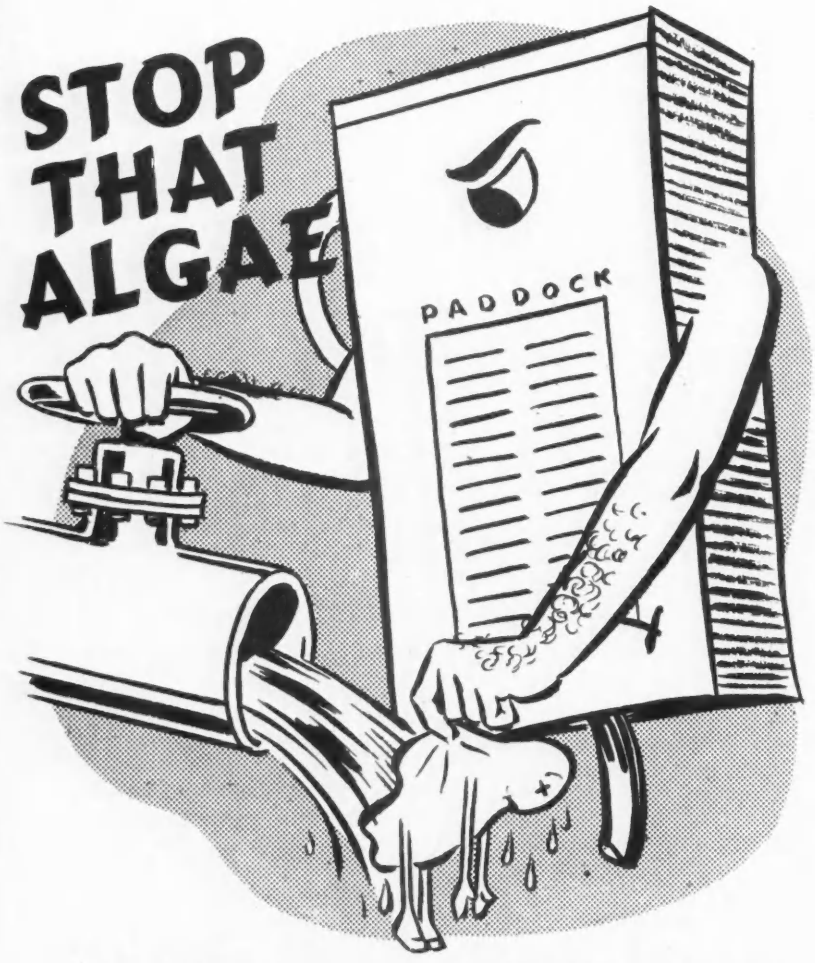
17—Gauge Case

A new gauge case is made of a high compression molded aluminum alloy and is called the Acaloy case. The surface of the case is treated by a patented process to prevent corrosion, and it is

claimed that the case will withstand 1500 hours salt spray test. Over this treated surface there is a black baked-on finish. The case is claimed to be weather-proof since it is provided with a synthetic rubber sealing gasket and a stainless steel snap ring.

For additional information write Helicoid Gage Division., American Chain & Cable Company, Inc., Bridgeport, Conn.

STOP THAT ALGAE



The PADDOCK High-Capacity CHLORINATOR picks 'em right out of the water. Destroys algae and other bacteria so harmful to cooling towers and water systems. The Paddock Chlorinator can handle up to 1,000 pounds per 24 hours within 4% positive control. Operates efficiently and economically. No float valves or float boxes to need replacement or repair. Working parts of silver, plastic or glass. Stop water-chlorination problems with a Paddock.

Ask us about SURECLOR, the new portable water-chlorinating unit for temporary camps.

Paddock Engineering Co. of Texas

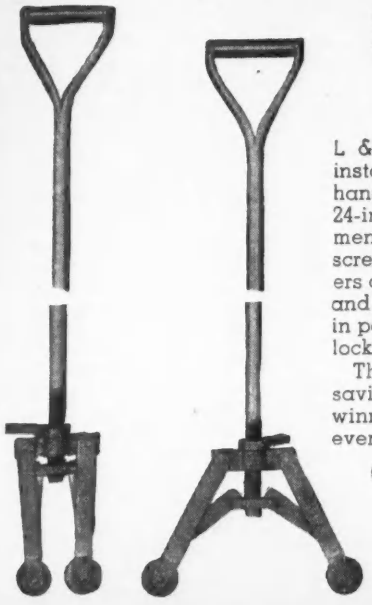
900 South Ervay Dallas 1, Texas

L&H

Adjustable

PIPE ROLLER

Saves Time and Labor



L & H Pipe Rollers are instantly adjustable to handle 2-inch tubing or 24-inch casing. Adjustment is made by turning screw handle until rollers are placed as desired and then locking handle in position by means of a lock nut.

This time and labor saving tool is quickly winning friends wherever pipe is handled.

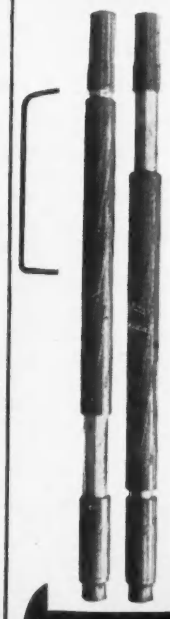
(Patents Pending)

24 Hour Service— 7 Days a Week

L & H MACHINE WORKS

2205 Quitman Street — Houston 10, Texas

BURRIS KEY SEAT WIPER...



OPERATORS HAVING 100% SUCCESS

No stuck drill collars after installing wiper tool

After one year of service by several major oil companies and drilling contractors, there has never been a failure with this tool when installed on top of drill collar. Tool has been used in the worst key seated wells and after fishing jobs with 100% success. Available on rental basis domestically. Sold export.

WRITE FOR COMPLETE DETAILS AND PRICES

J. J. BURRIS

2430 ALBANS ROAD

HOUSTON, TEXAS Phone J. 2-8277

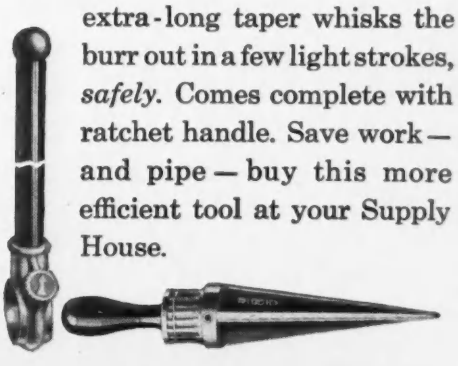
SOLD IN EXPORT

Long-Tapered

FOR SAFE, QUICK PIPE REAMING

Extra-long-taper RIDGID takes work and risk out of pipe reaming

● No thinning of pipe or conduit, no flaring or splitting it, even when you ream it extra fast—as this RIDGID encourages you to do. That extra-long taper whisks the burr out in a few light strokes, *safely.* Comes complete with ratchet handle. Save work—and pipe—buy this more efficient tool at your Supply House.



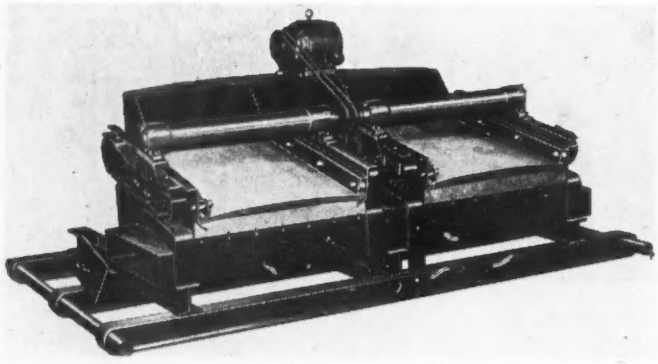
Reamer unit sold alone for use in RIDGID No. 00R Ratchet Threader handle.

RIDGID

WORK-SAVER PIPE TOOLS

THE RIDGE TOOL COMPANY • ELYRIA, OHIO

18—Dual Shale Shaker



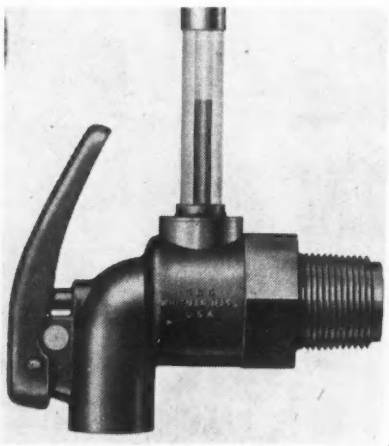
The Model 45, Type NRM-134 dual mud screen (shale shaker), size 36 x 48 inches, is completely unitized and readily transportable for reconditioning drilling mud on all wells regardless of depth. The self-contained unit includes two vibrating screens driven individually by V-belts from a single electric motor, steam turbine, gas or diesel engine; a built-in mud receiving box; a screened-mud collecting outlet or trough connection on either or both sides of the unit; and rugged, conveniently handled steel skids on which everything is compactly mounted.

The integral mud-receiving box is provided with threaded pipe connections for mud inlet pipe and bypass pipes. Separate mud-feeding weirs insure accurate division of mud between screens as well as low velocity, uniform distribution of mud to screen cloth. A slide gate inserted at feed weir will serve to direct the flow of incoming mud to either screen when it is not desired to use both screens. Flexibility of design of the new mud screen unit makes it possible to offer the purchaser this complete dual unit, or just the vibrating screen assembly consisting of screen box and cloth, vibrator and springs, ready for mounting on mud tank.

For further information write Link Belt Company, 307 N. Michigan Avenue, Chicago 1.

19—Gauge-Faucet

The No. 5 self-closing faucet when used with Gauge No. 55 provides visual measurement of contents remaining in 55-gallon drums while making withdrawals from the drum. Full opening through the heavy spring loaded valve permits fast flow. The valve is equipped with a Neoprene seat to provide a leak-proof, pressure-tested seal. Handle of the faucet accommodates padlocks having ¼-inch hasps to preclude unauthorized withdrawals. A hex shoulder cast in the body makes possible a wrench-tight connection. Extra long, tapered standard ¾-inch pipe threads are accurately machined.



The gauge is of Zomac and plastic components which are unaffected by temperature. The gauge fluid will not freeze and is sealed off with a Neoprene diaphragm. The faucets are also available without the gauge.

For additional information write C & C Die Casting Company, Inc., 60 South Street, Boston 11, Mass.

20—Clutches and Couplings

A series of bulletins are available in an attractive two-color paper cover. Products described in the standard-size folder are Brown Ring-Oiling Bushings, No. 22; Jackson Time-Saving Vise, No. 23; Brown Buffer-Slot Couplings, No. 24; Mule-Pull Clutches, No. 25; Kanti-Lever Flexible Couplings, No. 28; and Brown Sectional Stock Racks, No. 26.

Photographs, diagrams, specifications, and general descriptions are contained in these bulletins in additions to illustrations showing actual applications. Price lists are shown in most cases.

Obtainable from Brown Engineering Company, Reading, Penn.

21—Fluid Drives

Proven applications of Gyrol fluid drive in the oil well drilling industry are illustrated and described in a new eight-page bulletin, No. 8219. Printed in two colors, the publication describes precisely how the new drive works and how it is applied to the rotary, the slush pumps and the drawworks. The advantages of fluid drive in oil well drilling power applications are presented along with efficiency curves and fuel consumption charts. Photographs show actual field installations of the Gyrol fluid drive.

Copies may be obtained by writing American Blower Corporation, Hydraulic Coupling Division, Detroit 32.

22—Gas Lift

A 12-page, two-color catalog describes and illustrates Camco gas lift equipment and services. In addition to complete descriptions of the two types of flow valves and two types of controllers, the company's service is also discussed. A feature of the section on Camco service is a series of eight schematic illustrations which show various types of installations to solve difficult lifting problems.

A separate eight-page price list accompanies the catalog. This price list covers all Camco gas lift equipment and charges for Camco service.

Obtainable from Camco, Inc., 2015 C-West Gray, Houston.

DAN L. CLARK W. M. AVERILL RUPERT COX

DAN L. CLARK
DRILLING CO.

Drillers of

OIL AND GAS WELLS

POWER AND STEAM RIGS

NIXON BUILDING

CORPUS CHRISTI, TEXAS

Local 7746-7747 Long Distance 95

GUARD YOUR ENGINE'S HEART ZONE

LUBRICATE THE HEAT ZONE

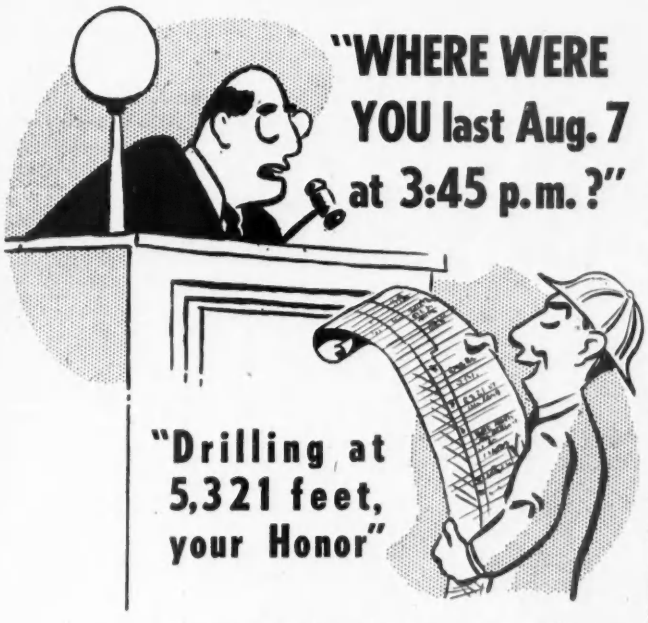
Your engine's heart zone is its heat zone—the top cylinder area. That's where vital valves must work—where heat is hottest, especially in gas-fueled engines—where sizzling temperatures scorch lubricants and leave bare metal unprotected . . . that's where Marvel Mystery Oil and the Marvel Inverse Oiler really go to work!

Marvel Mystery Oil is specifically compounded to resist heat. Here's liquid armor for your engine's heart—this *extra*-tough protective film cleans as it clads! Marvel dissolves sticky gum, sludge and varnish from valves, guides and rings—keeps them cleanly coated.

Your engine throbs with power when lubrication is right. Performance picks up, and "down time" stays down. Ask for the facts. Emerol Mfg. Co., Inc., 242 W. 69th St., New York 23, N. Y.

use the MARVEL INVERSE OILER WITH MARVEL MYSTERY OIL

The Marvel Inverse Oiler, easily installed, proportions the flow of Marvel Mystery Oil precisely to the needs of your engine.

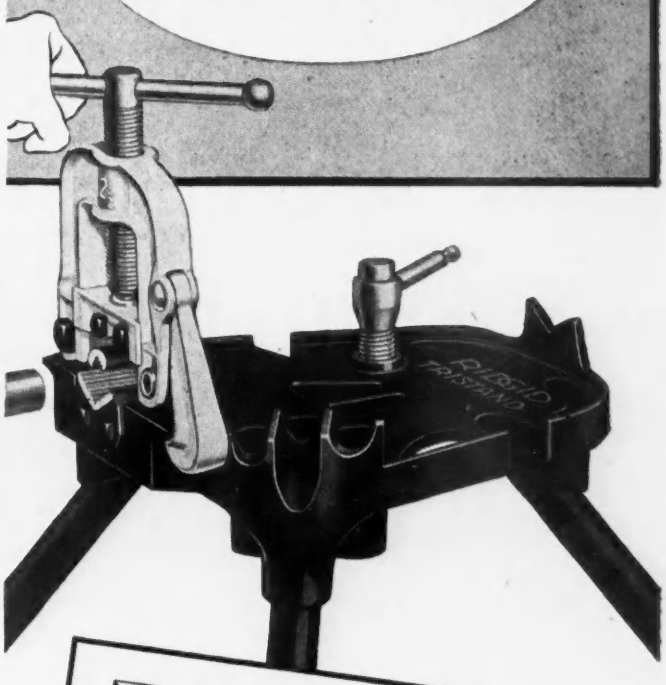


Keep up to the minute . . . know where you are ALL THE TIME by using Geolograph Mechanical Well Logging Service! It's complete enough for the largest . . . yet reasonable enough for the small operator.

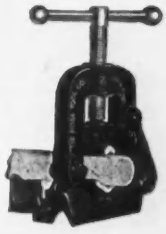
Write for details now!

"TIME WILL TELL"
THE GEOLOGRAPH CO. INC.
P. O. Box 1291 Oklahoma City 1, Okla.

A PIPE VISE *That's a handy Work Bench*



RIGID TRISTAND is portable and roomy —a big worksaver



RIGID *Vises include bench, post, stand models, yoke and chain.*

● You can carry the Tristand easily to and around the job—legs fold in—and you've got a convenient work-bench. Big tray for dope pot, oil can, slots for tools, pipe rest for easier cutting and threading, 3 handy benders that won't dent pipe. Yoke or chain vise with LonGrip jaws, safe for nickeled pipe. A worksaver bargain—buy at your Supply House.

RIGID
WORK-SAVER PIPE TOOLS
THE RIDGE TOOL COMPANY • ELYRIA, OHIO

23—Centrifugal Pumps

A bulletin in picture- magazine style describing Amsco-Nagle, ball bearing, type "T" industrial pumps features a minimum of copy and a maximum of photographs to present the facts of design and construction of these material handling pumps.

One series of photographs shows the complete start-to-finish assembly of a typical Amsco-Nagle pump: the two-bolt assembly of shaft, bearings, and bearing stand; the quick attachment of entire water end to bearing stand by two integrally-cast casing tubes; the screw-on impeller; and the clamp-on end plate.

Other photographs, diagrams, and cross-sectional views explain the features of the Amsco manganese steel water-end parts that assure the maximum in resistance to impact, shock, and abrasion.

Obtainable from American Manganese Steel Division, American Brake Shoe Company, Chicago Heights, Ill.

24—Expansion Joints

Bulletin EJ-46 describes the CMH Free-Flexing and Controlled-Flexing Bellows-Type Expansion Joints for controlling expansion, vibration, and misalignment in pipe lines having pressures to 300 pounds and temperatures to 900° F.

Free-Flexing and Controlled-Flexing designs with copper and stainless steel corrugations are illustrated, and data are given for each type in the bulletin. Sizes range from 4 to 24-inches inside diameters, with single and multiple corrugations.

Obtainable from Chicago Metal Hose Corporation, Expansion Joint Division, Maywood, Ill.

25—Pipe Line Trencher

A liberally illustrated eight-page bulletin on Parsons 200 Pipeline Trenchliner contains 30 photos with complete information explaining how cross-country pipe line jobs go through on schedule when Parsons 200 Trenchliner sets the pace for the pipe gang. Special working advantages includes 50 speeds to 20 feet per minute, and three special features that prevent wheel distortion. Complete specifications and drawing of power flow are included.

For additional information write Parsons, Newton, Iowa.

26—Flow Meters

A bulletin announcing a complete line of corrosive service flow meters describes instruments made of various corrosion resistant materials, such as porcelain, hard lead, heveg, glass, hard rubber, etc. Included also are dimensional details and a section on laboratory type flow meters.

A copy of this bulletin may be obtained from Dept. 3 G-E, Fischer & Porter Company, Hatboro, Penn.

27—Geiger Counter

Geiger counter theory and details of construction and operation are explained in a four-page folder (R1050), "Geiger-Mueller Counters Applied to Mining." Techniques with isotopes, use in pitchblend exploration, oil well logging, and geological surveys are treated at length. Several new fields are suggested wherein Geiger counters may help in locating valuable minerals, in assaying ore samples, in determining concentration and flow of certain products, and in scanning ore faces to determine grade. The folder is generously illustrated with photos, curves, diagrams and tables.

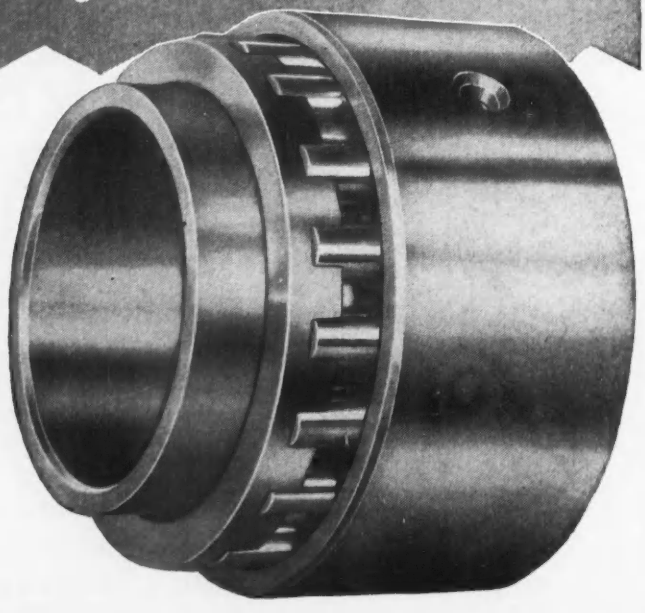
North American Philips Company, Inc., 100 East 42nd Street, New York.

28—Rotary Main Gears

Shop photographs showing the cutting of an Ideal rotary main gear feature a bulletin issued on the Type FE-17½ rotary machine for shallow to medium depth drilling. The bulletin, No. 341, also gives the general specifications of the machine, carries blueprints giving lubrication specifications and a series of explosion photographs showing the construction of the rotary.

Obtainable from The National Supply Company, P. O. Box 899A, Toledo 1, Ohio.

American
"Extra" Heavy-Duty
Roller Bearings
for the toughest anti-Friction jobs



Here is a "super" bearing designed especially for super heavy-duty service. Its simple construction, absolute precision and tremendous strength assure smooth, dependable performance in the heaviest machinery under the most difficult operating conditions. Complete technical data furnished without obligation. Write.

AMERICAN
ROLLER BEARING CO.
420 Melwood Street Pittsburgh, Pa.

AMERICAN ROLLER BEARINGS HEAVY DUTY

Pacific Coast Office: 1718 S. Flower St., Los Angeles, Calif.

Men in the Industry NEWS

Joseph P. Walsh

Joseph P. Walsh has been elected general counsel of Sinclair Oil Corporation, succeeding **P. C. Spencer,** who recently became president of Sinclair Refining Company. Walsh, who holds a Doctor of Jurisprudence degree from Brooklyn Law School, St. Lawrence University, entered the legal department of the Sinclair organization in 1928, and advanced to assistant to general counsel in 1946.

E. N. Avery has been appointed general manager of Shell Company of Australia and will be stationed in Melbourne. He was formerly assistant manager in Australia and is chairman of Shell Queensland Development Co., Ltd.

Sir George Cunningham resigned his seat on the board of Attock Oil after being appointed Governor-Designate of the North-West Frontier Province of Pakistan.

L. G. Smith was elected a vice president of Creole Petroleum Corporation, affiliate of Standard Oil Company (N. J.). He entered the petroleum industry in 1913, was general manager and later president of Lago Oil and Transport Company, Aruba refinery, and was decorated by Queen Wilhelmina for his services. He joined Standard's foreign refining department in 1946.

Arthur R. McQuiddy has been appointed executive secretary of the New Mexico Oil & Gas Association, succeeding **Jack M. Campbell,** who will remain with the association as legal and tax advisor, in addition to maintaining law offices in Albuquerque. McQuiddy was managing editor of the Roswell Morning Dispatch.

Dr. A. E. Dunstan has been appointed one of the British delegates to the General Assembly of the International Union of Chemistry.

Robert W. Harrison, chief engineer of Standard Oil Company of Texas, has resigned to enter a consulting engineering office with **R. B. Mitchell.** The firm is known as R. B. Mitchell Company, Consulting Geologists & Engineers, Petroleum & Natural Gas, and offices are in the City National Bank Building, Houston.

E. W. Allgower was appointed treasurer of The Standard Oil Company (Ohio) and its subsidiaries. He has had more than 30 years' service with the company, and for the past eight years has been assistant treasurer. He joined Standard as a clerk upon graduation from Ohio State University in 1917. In 1931 he was made assistant treasurer of Refiners, Inc., a subsidiary, and went to Cleveland two years later as assistant chief clerk in the Central Accounting Office.

E. W. Allgower

H. E. Hanson, a member of the board of directors for Standard Oil Company (Indiana), has retired. He was succeeded on the board by **Joseph K. Roberts,** general manager of research.

J. R. Fanshawe, assistant division geologist with General Petroleum Corporation, has accepted a position as Rocky Mountain division geologist with Seaboard Oil Company of Delaware.

can you identify

this oil product?

Next time you put a nickel in a juke box, remember you're giving an oil product a whirl. Yes—your favorite phonograph record is likely to be made from asphalt, an oil derivative.

can you identify

good ROPE?

Worth remembering is this name for good rope: NEW BEDFORD. Accepted among oil men for its long superior service. The next time you order rope, specify New Bedford. Meanwhile, take good care of the New Bedford rope you have on hand.

3004

NEW BEDFORD CORDAGE CO.

233 BROADWAY · NEW YORK 7, N. Y.

31 St. James Ave., Boston 16, Mass. · 325 W. Huron St., Chicago, Ill.

Mills: New Bedford, Massachusetts

3 Fast Daily Flights

TO THE

PERMIAN BASIN FIELD

From Houston, Dallas, Ft. Worth, Abilene, San Angelo, Amarillo, Lubbock, to

MIDLAND-ODESSA

Pioneer Air Lines offers morning, noon and night flights from Texas Metropolitan oil centers into West Texas and return. Flights are planned for the oil man's busy day with three convenient arrivals and departures daily. Consult your local Pioneer office for reservations.

	Phone
HOUSTON	W-9-4691
DALLAS	D-4-3939
FT. WORTH	6-8458
MIDLAND-ODESSA	2544
SAN ANGELO	7196
AMARILLO	2-6767
LUBBOCK	4646
ABILENE	6606

PIONEER AIR LINES

PIONEER Air Lines

GOVERNMENT DESIGNATED TO FLY AIR MAIL — PASSENGERS — EXPRESS

Men in the Industry NEWS

E. G. Collado, former U. S. executive director of the International Bank for Reconstruction and Development, has joined Standard Oil Company (N. J.) as foreign exchange manager in the Treasurer's Department. Before his appointment as executive director of the International Bank, Collado was associated with the State Department in Washington from 1938 to 1946. Previously, he was connected with the U. S. Treasury Department and Federal Reserve Bank of New York.

Alan G. Skelton, staff assistant of the Kansas-Oklahoma Division, Mid-Continent Oil & Gas Association, has resigned to become head librarian of the Waterways Experimental Station of the U. S. Engineers Corps at Vicksburg, Miss.

»

A. L. Pym of the Anglo-Iranian Oil Company, is to arrive in Australia early next year to take over the general managership of the Australian Petroleum Company from **C. Saunders,** who has been appointed London manager to Middle East Pipe Lines Company.

M. W. Sheppard, Jr., was appointed manager of the land department of Shell Oil Company in California. He replaces **Walle Merritt,** who is retiring after 25 years with Shell. Merritt became manager of the land department in the Pacific Coast territory in 1929. Sheppard joined the company in 1933 as a production engineer, and has held various executive positions in the Los Angeles and San Francisco offices.

M. W. Sheppard, Jr.

»

Lt. Commander Laurence C. Bergquist, New York, has been awarded the Legion of Merit and authorized to wear the Combat "V" for "exceptionally meritorious conduct" in the Gilberts-Marshalls' area in 1944-45. Bergquist, a member of the foreign staff of Standard-Vacuum Oil Company since 1928, was cited for his leadership and initiative in organizing, coordinating and administering military government activities affecting more than 6000 natives in the Marshalls groups.

»

George Acuff, formerly Rocky Mountain superintendent for Kerr-McGee Oil Industries, has joined **B. F. Allison,** Cut Bank, Mont., in the Acuff-Allison Drilling Company. The company has contracted with The Ohio Oil Company for an extension test of the Dry Creek field, Carbon County, Mont.

»

Friedrich Gartner, managing director of the Shell's Roumanian subsidiary "Astra-Romana" recently celebrated the 40th anniversary of his joining the Shell group.

»

G. E. Bertram has retired on pension after 52½ years service with Anglo-American Oil Company. At a lunch in York he was presented with a gold diamond-studded star.

»

Dr. Kirtey F. Mather of Harvard addressed scientists in Dundee on August 29th on "Petroleum Today and Tomorrow." The address was given under an arrangement between the British and American Associations for the Advancement of Science.

»

Richard Hopper, with Standard Oil Company of California in the Dutch East Indies, is in Southern California on vacation. He intends to leave for the Indies September 26.

»

John H. Melvin has been appointed state geologist and chief of the Ohio State Geological Survey. A former executive of the Pennsylvania Drilling Company, he recently has been district geologist, Corps of Engineers at Omaha, Nebr.

Use Acme Cable Tools

Trustworthy Since 1900

Acme Trip Casing Spears are champion pipe-pullers. Patented features help do their important recovery job: easier, quicker—without damage to pipe . . . There's plenty of proof-history behind these fact-claims, too.

Born of 47-years' field experience, by our own fishermen: Acme Casing Spears—finger trip ring, 3, 4 and 8-slip types—are now standard equipment with several "majors" and hundreds of "independents" everywhere. Why? . . . Simply because of that known Acme stamina and trustworthy operation, so desired in Spears—for long, rigorous use.

Exclusive features: Full-circle hitch, prevents oblonging while jarring. Non-breakable slips, due to long slip seats and finger-style ring. "Vital parts" of special carbonized alloy steels. Extra body strength where most needed. And quick-setting, positive-action tripping device, for various casing weights.

At-the-well superior performance is safeguarded by Acme's traditional policy: From billet to finished Spear, every detail must conform to our rigid specifications and analyses of extra cost, CORRECT steels; modern, automatically controlled heat-treatment processes, and craftsmanship not dictated by "stop-watch timing."

In addition to featured Casing Spear (Fig. 247 — of Finger Trip Ring, 3-slip type) see color panel for other Acme Fishing Tools — for your dependable use.

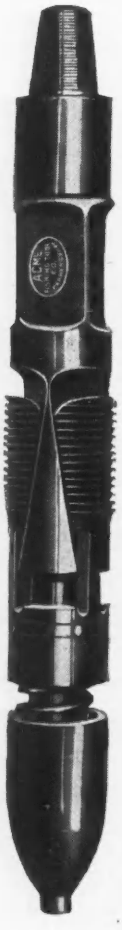
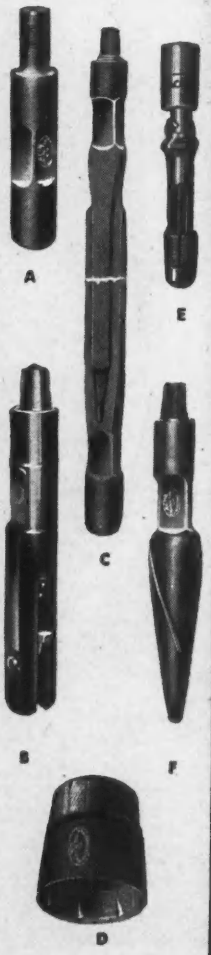


Fig. 247
Acme Trip Casing Spear

* * *

For more information, see our 24-page Catalog in Composite Catalog (Vol. 1). Or tell us your needs, by TODAY'S mail.

More of EVERYTHING You Need in an Acme String . . .



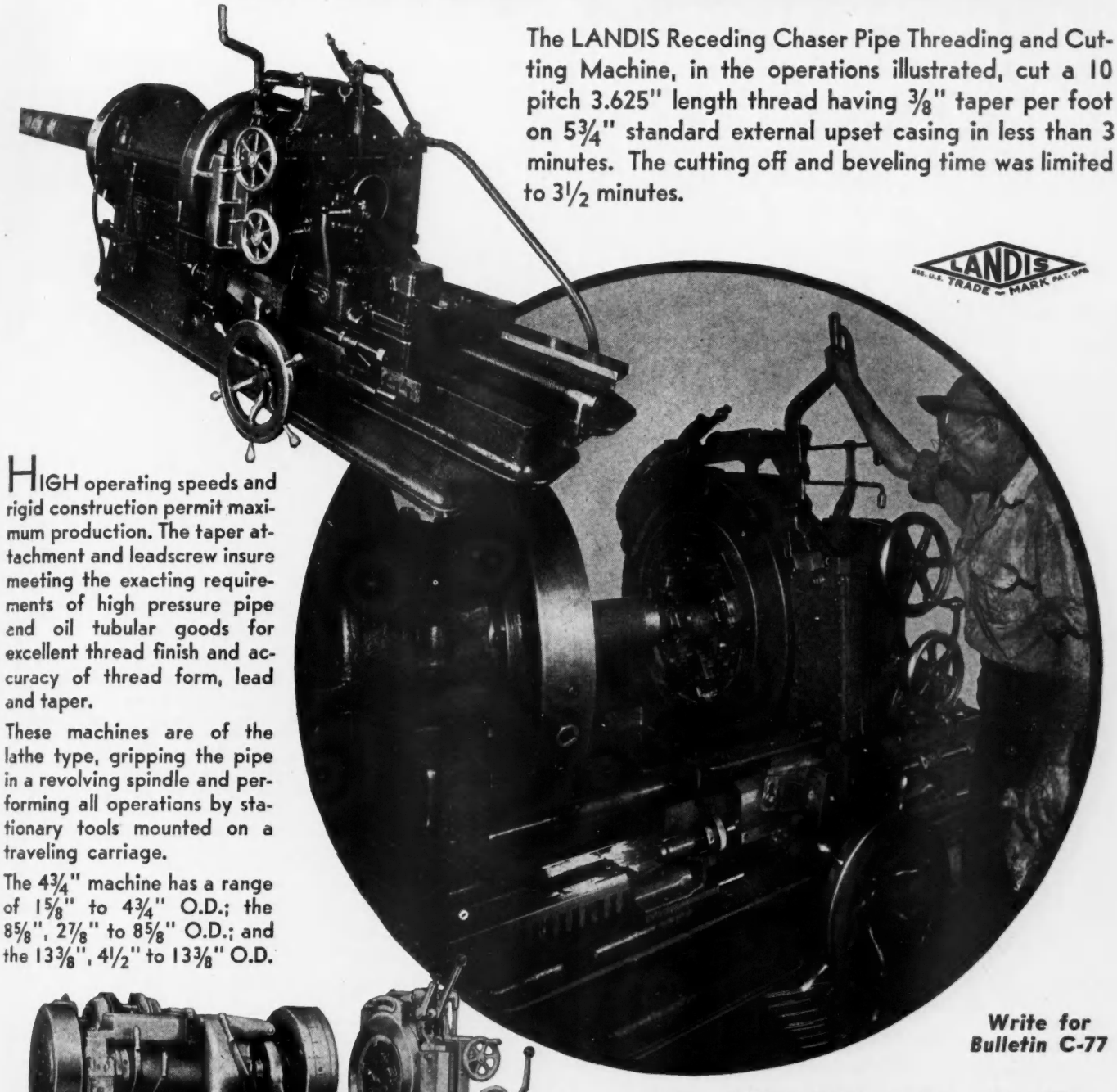
A—Babcock Rope Socket
B—Collar Buster
C—Long Stroke Jar
D—Die Nipple
E—Hollow Spear
F—Mandrel or Swage

Acme Fishing Tool Co.
PARKERSBURG, W. VA.
Export Office: 19 Rector St., New York 6, N. Y.

ACME DRILLING & FISHING TOOLS Since 1900

ACCURATE TUBULAR GOODS
at HIGH PRODUCTION

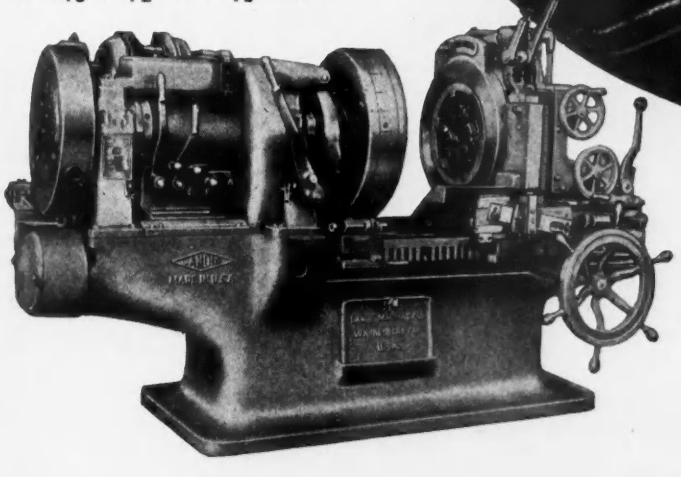
The LANDIS Receding Chaser Pipe Threading and Cutting Machine, in the operations illustrated, cut a 10 pitch 3.625" length thread having 3/8" taper per foot on 5¾" standard external upset casing in less than 3 minutes. The cutting off and beveling time was limited to 3½ minutes.



HIGH operating speeds and rigid construction permit maximum production. The taper attachment and leadscrew insure meeting the exacting requirements of high pressure pipe and oil tubular goods for excellent thread finish and accuracy of thread form, lead and taper.

These machines are of the lathe type, gripping the pipe in a revolving spindle and performing all operations by stationary tools mounted on a traveling carriage.

The 4¾" machine has a range of 1⅝" to 4¾" O.D.; the 8⅝", 2⅞" to 8⅝" O.D.; and the 13⅜", 4½" to 13⅜" O.D.



Write for Bulletin C-77

LANDIS
MACHINE COMPANY
WAYNESBORO, PA., U.S.A.

THREADING MACHINERY—THREAD CUTTING DIE HEADS—COLLAPSIBLE TAPS

YOUR ASSURANCE IT'S DESIGNED RIGHT, BUILT RIGHT...

the RIGHT POWER

TO MEET THE MOST EXACTING REQUIREMENTS

To users, dealers, and builders of gasoline powered equipment the world over, the trade-mark on a Briggs & Stratton engine is more than a label. It is a *seal of quality*—backed by the performance record of over 3 MILLION Briggs & Stratton engines during more than 28 years of *continuous production*. No other manufacturer has built so many 4-cycle air-cooled engines, or has had such long experience in building them. That's why the name BRIGGS & STRATTON stands for all that is best in meeting your most exacting power requirements.

Preferred Power FOR INDUSTRIAL CONSTRUCTION RAILROAD AND FARM EQUIPMENT

BRIGGS & STRATTON CORPORATION
Milwaukee 1, Wisconsin, U. S. A.

Men in the Industry NEWS

Robert I. Brougham

Robert I. Brougham has been elected financial vice president of Arabian American Oil Company, Saudi Arabian operating company. He formerly was an assistant treasurer of Standard-Vacuum Oil Company and treasurer of Creole Petroleum Corporation. More recently he was foreign exchange manager of Standard Oil Company (New Jersey).

B. G. Banks, for 24 years refinery manager in Trinidad for Trinidad Leaseholds has returned to England and is in the company's London headquarters.

»

R. J. Forbes, formerly of Royal Dutch Shell, has been appointed to the Chair of History of Natural Sciences and Technology in the University of Amsterdam.

»

Hugh Wallace, former executive head of the Harris County Association for Industrial Peace, has announced the opening of an office in the Commerce Building, Houston, where he will practice as a counsellor in industrial relations.

»

Walter E. Long is in charge of the new geological office at Tyler of Geier-Jackson, Inc. For the past three years he has served with Magnolia Petroleum Company's geological department in the same city, and before that was a geologist with Anaconda Copper Company in Montana. The firm's holdings are predominantly in East Texas.

»

Bart de Laat is general manager for The Brazos Oil and Gas Company, a new organization which has opened offices in the City National Bank Building, Houston, and holds interests in the Upper and Lower Gulf Coast.

»

Dr. P. F. Hawley, patent attorney for Stanolind Oil & Gas Company, spoke on "Patent Law," and **T. E. DeVilliers,** Cities Service Oil Company, Bartlesville, discussed "Engine Testing of Lubricating Oils" before the Tulsa Section, American Chemical Society, at Okmulgee, Okla.

»

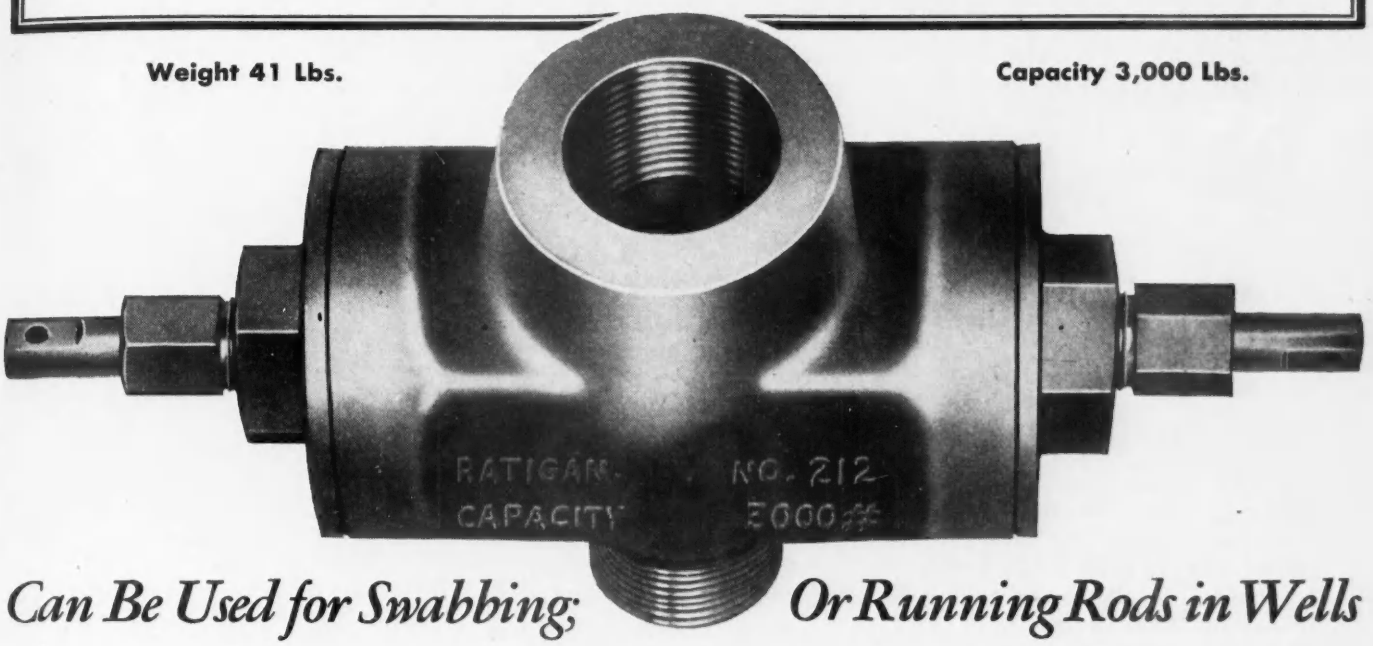
Governor Roy J. Turner of Oklahoma will deliver the opening address at the third annual membership meeting of the Independent Natural Gas Association of America at the Skirvin Hotel, Oklahoma City, October 24. Among papers to be presented will be "Synthetic Liquid Fuels and Chemicals from Natural Gas," by **George Roberts, Jr.,** Stanolind Oil & Gas Company of Tulsa.

»

Ben S. Dawson, superintendent of the Land Department for Kerr-McGee Oil Industries, Inc., was to retire October 1.

RATIGAN No. 212 IMPROVED BLOWOUT PREVENTER

Weight 41 Lbs. **Capacity 3,000 Lbs.**



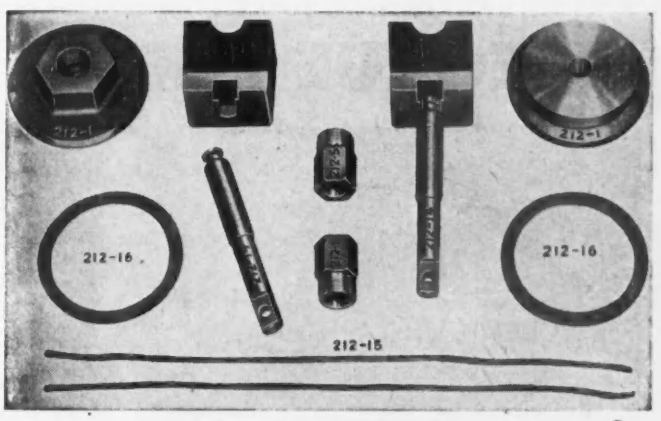
Can Be Used for Swabbing; Or Running Rods in Wells That Head or Flow in the Course of Operation

Two Ratigan No. 212 Blowout Preventers of the same size, with a nipple of any required length in between, make an efficient unit for swabbing. The device also can be used for running rods in wells that head or flow in the course of operation.

Made of high pressure electric steel, it has a capacity of 3,000 pounds, yet weighs only 41 pounds, providing an ample safety factor under all service conditions.

It is equipped with Ratigan new type retractable rubbers, which can be changed exceptionally fast by simply unscrewing the plugs at each end, when the old rubbers are readily accessible for replacement.

Made in 2½" and 3" sizes, both plain and upset. The 2½" plain type can be supplied in double-female; and if male and female are required, a short nipple can be used to make the change. The 2½" upset can be supplied in both male and female types. The 3" size is supplied in male and female types only; and the male connection easily can be converted to female by installing a 3" collar, making a double female unit.

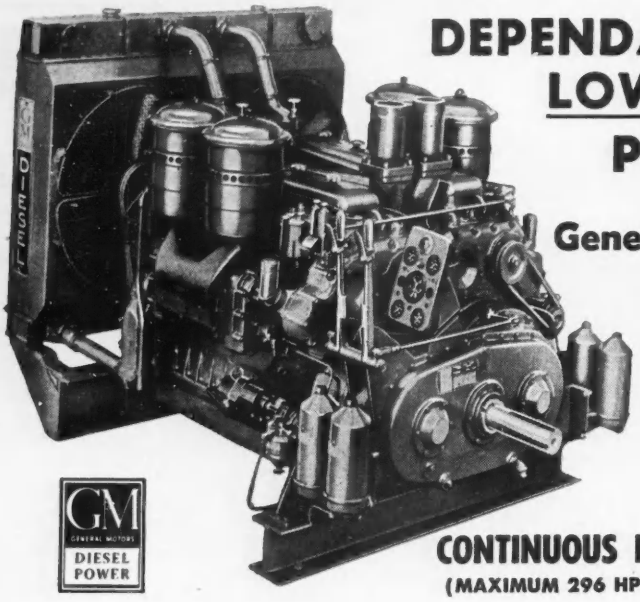


If your supply store cannot furnish these products, write or wire us direct. Also, consult the Composite Catalog for detailed information on all Ratigan products.

J. P. RATIGAN, INC.

1213 Santa Fe Avenue **Los Angeles 21, California**

Ratigan Products Are Distributed Through Leading Supply Stores



DEPENDABLE, LOW-COST POWER!

General Motors Twin 6-71 DIESEL

260

CONTINUOUS HORSEPOWER

(MAXIMUM 296 HP RESERVE POWER)

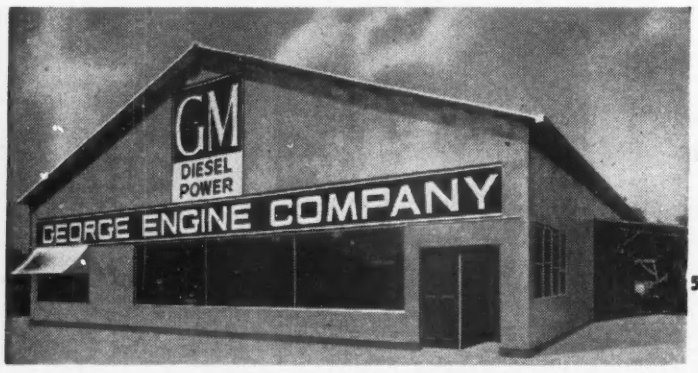
GM DIESEL POWER

Drilling in the oil fields is a 24-hour-a-day operation; and, an oil man's power must be dependable . . . It has to be compact and portable and require a minimum of maintenance. GM Diesels meet these requirements and more . . . They provide plenty of rugged power in a relatively small space and with low weight (only 21 pounds per horsepower). They're quick to start, they give smooth operation, and they're economical. Small wonder that more and more drillers are turning to General Motor Diesels!

There is a GM Diesel for your every need . . . ranging in size from 30 to 700 Horsepower. Most models in stock in our New Orleans plant. Write for brochure.

Parts and Service — Around the Clock

GEORGE ENGINE CO.



MAIN PLANT
1111 Jefferson Hwy.
New Orleans, La.

LAKE CHARLES BRANCH
512 Railroad Ave.
H. F. COLBY
Manager

Please Send Me WORLD OIL

Name_____

Company_____ Position_____

Street and No._____

City and State_____

REMITTANCE ENCLOSED

$2 for 1 yr.; $3 for 2 yrs.; $4 for 3 yrs.

Please check branch of industry in which engaged:

☐ Drilling Contractor ☐ Individual Producer ☐ Manufacturing
☐ Producing Company ☐ Pipe Line ☐ Supply

Men in the Industry NEWS

P. G. Carpenter

P. G. Carpenter has been made section chief of the reorganized production research section of the physics division of Phillips Petroleum Company. He formerly was with Hercules Powder Company. **T. A. Matthews, W. L. Morris** and **H. B. Fisher** are group leaders under his direction. Matthews is in charge of reservoir engineering, and has been employed in reservoir work with Phillips since his graduation from the University of Arkansas. Morris is in charge of production physics. He formerly was with Gulf Research and Development Company and Kuwait Oil Company. He has a Ph.D. in mathematics from Duke University. Fisher, in charge of production chemistry, holds a Ph.D. from the University of Illinois. He formerly was with the Aluminum Company of America, and the Darce Corporation.

Clinton Owsley, director of public utilities in Houston and former chief supervisor of the oil and gas division of the Texas Railroad Commission, spoke on "Utilities Regulation" at the monthly meeting of the Oil Men's Club of Houston.

E. V. Spence, Big Spring, Texas, has been appointed to the Texas Board of Water Engineers by **Governor Beauford Jester.**

Paul Netterstrom, formerly geologist with The Ohio Oil Company, has been employed by Barnsdall Oil Company as Rocky Mountain geologist and will maintain an office at Casper, Wyo.

James P. Hart, Jr., of Austin has been appointed by **Governor Beauford Jester** to fill the unexpired term of **Judge C. S. Slatton** on the Texas Supreme Court. Judge Slatton resigned to become chief counsel for Southwestern Bell Telephone Company in Dallas. Hart was associated with the Hawkins case, and has practiced a great deal of oil law.

T. E. Swigart, president of Shell Pipe Line Company, is president of the Community Chest and Council of Houston and Harris County, Texas, a position which at once means a high compliment to the man holding it, and a great deal of hard work for the community as well.

L. E. Barrows, formerly general superintendent for The Texas Company, now retired but acting in a consulting capacity, is on a trip through Trinidad, Venezuela and Colombia.

Wallace W. Wilson, formerly research engineer with California Research Corporation with headquarters at the Whittier, Calif., laboratory, has accepted a position as assistant professor of petroleum engineering at University of Texas.

DESIGNERS! ENGINEERS! OPERATORS! MAINTENANCE MEN!

There's profitable reading in the neoprene notebook!

It's punched for easy filing

- **NEW METHODS OF REDUCING MAINTENANCE COSTS**
- **NEW SOLUTIONS OF PRODUCTION PROBLEMS**
- **NEW IMPROVEMENTS ON OLD PRODUCTS**
- **NEW PRODUCTS**

Put your name on our mailing list NOW for your FREE subscription

Here are interesting articles written from the technical man's point of view on the latest designs . . . the newest production methods . . . ideas for cutting operating costs. Helpful information about the properties and uses of neoprene appears in *The Neoprene Notebook.* And each issue adds to a valuable reference volume you'll use over and over again. We'll send you each issue *free.* Just clip out the coupon below and mail it today.

READ HELPFUL ARTICLES LIKE THESE IN THE NEOPRENE NOTEBOOK

Performance in outdoor aging tests shows resistance of neoprene to sunlight—oxidation. *(Issue No. 35, page 181)*

New resilient machine mountings isolate unwanted vibrations. *(Issue No. 19, page 73)*

Hydraulic hose made of neoprene helps make production records. *(Issue No. 37, page 202)*

New gaskets combine properties of asbestos and neoprene for improved heat resistance. *(Issue No. 25, page 108)*

New aerial cable designs improve electrical service. *(Issue No. 36, page 192)*

Roll replacement costs cut by new patching material. *(Issue No. 37, page 198)*

CLIP OUT THIS COUPON *and mail it to us for your FREE subscription to* **The Neoprene Notebook.** *You'll profit by the latest information on the rubber made by Du Pont.*

E. I. du Pont de Nemours & Co. (Inc.)
Rubber Chemicals Division K-10
Wilmington 98, Delaware

Please send me free issues of **The Neoprene Notebook.**

*Name*_____ *Position*_____

*Firm*_____

*Address*_____

FOR BETTER EQUIPMENT, SPECIFY

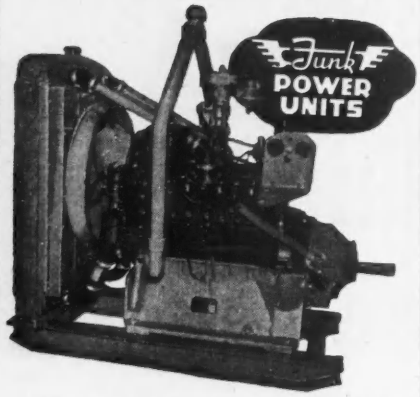
NEOPRENE

The rubber made by Du Pont

BETTER THINGS FOR BETTER LIVING
. . . THROUGH CHEMISTRY

DU PONT
REG. U. S. PAT. OFF.

LONGER LASTING—LOW COST *POWER UNITS*



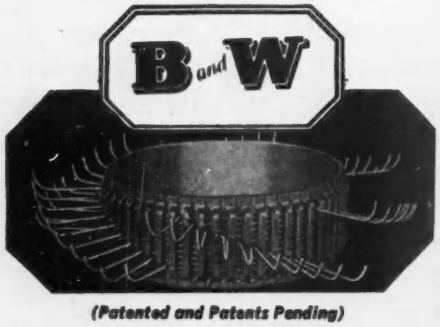
The Funk Manufacturing Co., has adapted Ford engines to industrial use by installing these heavy-duty components:

- Cool Running Oversize Radiator
- Heavy-duty Industrial Clutch
- Large Oil Capacity Crankcase
- Rugged Skid Base

3 SIZES { Ford 4—40 H.P. / Ford V8—100 H.P. / Lincoln—V Type Engine

Write for Free literature giving pertinent information on these dependable power units.

Funk MFG. CO.
COFFEYVILLE, KANSAS



(Patented and Patents Pending)

Enough B & W Wall Cleaning Guides to give you a good cement job cost only 1/10th as much as any squeeze job.

DON'T SQUEEZE!
It Can Be Avoided

BRUCE BARKIS · B-W INCORPORATED · KENNETH WRIGHT
Well Completion Specialists
HOUSTON, TEXAS • LONG BEACH, CALIF.

Men in the Industry NEWS

Byrnes MacDonald was appointed assistant director of public relations and advertising for Sinclair Oil Corporation and subsidiaries. He became connected with Sinclair in 1946 as executive assistant to the president, following his retirement from the Navy as lieutenant commander. He has served on the staff of the National Recovery Administration in New York, as deputy police commissioner of New York, as deputy commissioner in the department of Welfare, and was secretary to Mayor LaGuardia before the war.

Byrnes MacDonald

Oren C. Baptist has left General Petroleum Corporation to join the U. S. Bureau of Mines at Laramie, Wyo.

Max Roberson, formerly with Simpson-Fell Company, is now with Fred M. Manning, Inc., drilling contractors.

Irv Hardman, chief geologist for Derby Oil Company at Wichita, Kansas, has resigned to become a consulting geologist.

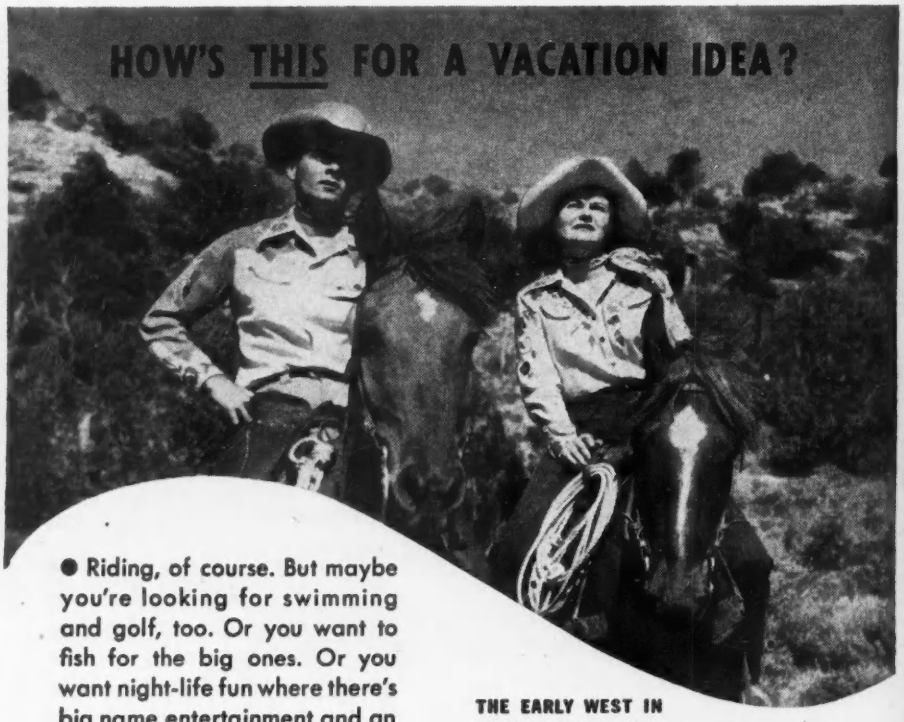
Charles Rayner has submitted his resignation as petroleum adviser to the State Department to Secretary Marshall. If the post is not filled, according to some conjectures, **John Loftus,** as chief of the petroleum division, will become ranking petroleum officer of the department. Loftus gave as reason for his resignation the need of a rest.

David R. Stewart has moved to Mattoon, Ill., to become associated with **Carl E. Moses** in independent oil operations in the Tri-States area. He was an attorney in Mt. Pleasant, Mich., for ten years. Moses has been acting as an independent in Illinois for the past two years, and was a geologist for Turner Petroleum Corporation before induction into the armed services in 1942.

E. G. (Eddie) Cole was promoted to division geologist for Sinclair Prairie Oil Company and is chief geologist for the Texas division, with headquarters at Fort Worth.

Will H. Pattison will supervise all of Deep Rock Oil Corporation's land exploration activities in Kansas.

H. M. Williams, John L. Fye, and **Charles W. Sanders** are partners in the H. M. Williams Drilling Company at Olney. **W. G. Goss** is office manager.



● Riding, of course. But maybe you're looking for swimming and golf, too. Or you want to fish for the big ones. Or you want night-life fun where there's big name entertainment and an exciting casino. Or maybe just lazing the days away under a smiling sun is your idea of the perfect vacation. Then your spot is the Hotel Last Frontier in Las Vegas, Nevada.

THE EARLY WEST IN MODERN SPLENDOR

Hotel LAST FRONTIER
LAS VEGAS NEVADA

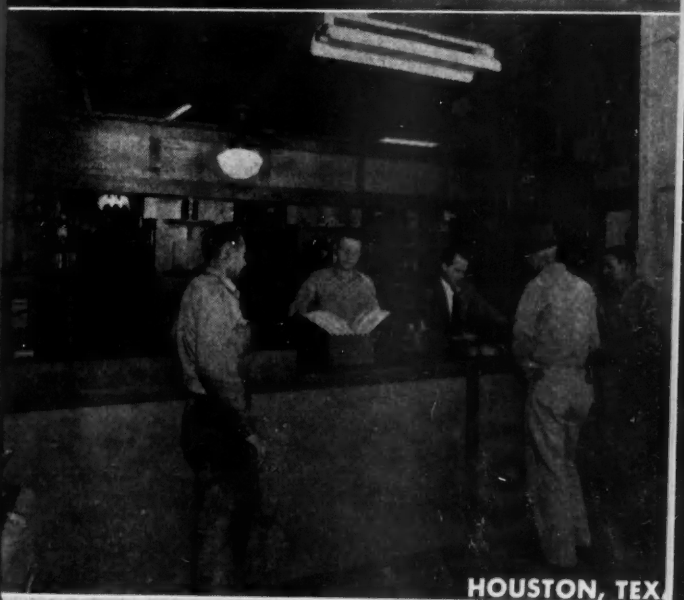
Write for Colorful Folder

WHEREVER THERE'S OIL...
there's BUDA
ENGINES and SERVICE

SEMINOLE, OKLAHOMA

DALLAS, TEXAS

The responsibility of The Buda Company to the ultimate user does not end with the design, manufacture and shipment of dependable Oilfield Engines. Since the first BUDA engine was built in 1910, it has been our constant policy to *keep BUDA power always on its toes.* In your BUDA Oilfield Engine Distributor's shop are factory trained maintenance men who are part of every BUDA engine you buy, so take advantage of their capable service.



HOUSTON, TEX.

BUDA

15436 Commercial Avenue
HARVEY *(Chicago Suburb)* ILLINOIS

See Your Nearest BUDA Oilfield DISTRIBUTOR:

● TEXAS—Alice, Dallas, Houston, Kilgore, Odessa, Pampa, Wichita Falls
OKLAHOMA—Oklahoma City, Seminole, Tulsa • CALIFORNIA—Bakersfield, Long Beach, Los Angeles • KANSAS—Great Bend, Ulysses • NEW MEXICO—Artesia • MISSISSIPPI—Brookhaven, Tinsley • LOUISIANA—Shreveport
COLORADO—Denver • WYOMING—Casper • ILLINOIS—Salem • NEW YORK—New York (Export)

TULSA, OKLAHON

Men in the Industry NEWS

Transfers

Harold Sidwell, petroleum engineer for Sinclair Prairie Oil Company, from Drumright, Okla., to the Houston office. **Lee Osborne,** Shell Oil Company, from Bakersfield, Calif., to Calgary, Canada, as manager of operations for Shell. **Ray Gengler,** head of The Texas Company's Rocky Mountain legal department, to New York City. **Walter Will** replaces him. **C. A. Robison,** former assistant manager of The Continental Supply Company store at Healdton, Okla., to Artesia, Colo., as store manager, succeeding **Byron Lasseter,** resigned. **W. M. Saxon,** manager of The Pure Oil Company's Michigan producing division, to Billings, Mont., December 1, as manager of the company's Rocky Mountain division. Saxon was made manager of the Michigan division in April. **Harry J. Lowe,** now manager of Pure's eastern division with offices at Newark, Ohio, to assume management of the Michigan division. **Dick Strohmeyer,** Skelly Oil Company's geological department, to Wichita, Kansas.

FOLKS, MEET
HY—THE JUNK MAN!

You'll have to excuse him, tho.... He's rushing out to *"Unclutter"* a well.

Yes, Hy (short for Hydrostatic, the force that works **for you** in all Cavins Fishing and Cleanout tools) is on his way to get some drilling contractor or producer out of trouble.

If he wasn't in such a hurry, he'd stay around and tell you more about Cavins Fishing and Cleanout services . . . about the **original** Cavins Bailer and the Hydraulic Fishing Tool . . . Cavins Sand Pumps and Perforation Washers . . . and the **new,** highly efficient Drill Pipe Fishing and Cleanout Tool. He'd tell you how, for many years, these Cavins Tools have served operators the world over, removing sand, junk and debris from wells of all depths and under all conditions.

Yes, Hy is a "junk man" from 'way back . . . **he specializes in collecting junk from the bottom of producing wells or drilling holes** and depositing it carefully on the surface, where it cannot further interfere with profitable well operations.

Hy will be back next month and he'll probably have an interesting story to tell about the job he's doing today. In the meantime, if **you** have a collection of junk or debris in one of your wells, call Hy . . . he'll remove it quickly . . . economically . . . completely.

THE CAVINS CORPORATION

Houston • Kilgore • Corpus Christi
Odessa • Lake Charles • Ellinwood

CAVINS

Ralph Haddox, assistant manager of the tubular department of Oil Well Supply Company, from Charleston, W. Va., to Pittsburgh. He was appointed to his former position in March, and before that was president and general manager of United Pipe and Supply Corporation of Charleston. **Floyd Hall,** drilling foreman with E. F. Moran Drilling Company, from the Evansville, Ind., office to San Angelo, Texas, office. **George R. Wesley,** Skelly Oil Company, from Evansville, as district geologist, to the main office in Tulsa. **Ben Ploch** will be in charge of the Evansville office. **Dewey Bagwell,** Gulf Refining Company scout, from Michigan to Evansville offices. **J. W. (Joe) Meehan,** promoted to vice president of Pure Transportation Company, from Olney, Ill., to the Chicago office after special study at Harvard University. **W. F. (Bill) Stebbins** is now in charge Pure's Illinois department at Olney.

»

Rex Crockett has joined Aurora Gasoline Company as scout. His offices are at Olney, Illinois.

»

A. E. (Al) Sweeny, Jr., former associate professor of petroleum engineering at the University of Texas, has been appointed field engineer for the Fairbanks Operating Committee in a joint repressuring program at Fairbanks, Texas. He held the rank of colonel in the U. S. Army Engineers Corp at the time of his release from active duty in the recent war, at which time he returned to the university as an associate professor. A graduate of the U. S. Naval Academy, Sweeny received his B.S. degree in Petroleum Engineering from the University of Texas. His new headquarters are located at the Warren Petroleum Corporation's gasoline plant at Fairbanks.

»

V. E. Staley, formerly assistant division engineer for Stanolind Oil & Gas Company's Gulf Coast District with offices at Houston, has been made Industrial Relations Superintendent for the company's Rocky Mountain Division.

»

O. D. Donnell, president and general manager of The Ohio Oil Company, announced a new plan replacing the current $35 per month cost-of-living bonus which has been paid since January 1, 1947. A General wage increase of 15 cents per hour for all regular hourly-rate employes is now effective. A bonus of 10 cents per hour for these employes was made effective from October 1 through June 30, 1948. Salaried rates are being adjusted and a comparable bonus granted, exclusive of top executives of the company.

»

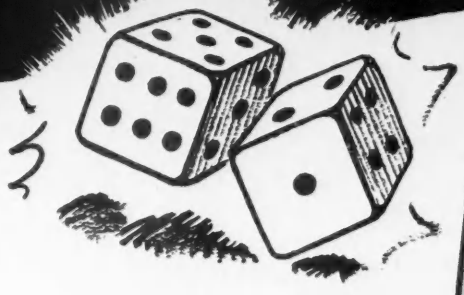
Paul E. Fitzgerald of Dowell Incorporated, Tulsa, was elected vice-chairman of the Petroleum Division of AIME.

»

Harold J. Chopard has resigned as treasurer of Simrall Corporation, effective December 31. He joined the firm as treasurer in 1935, having been employed previously at Cleveland.

Use these EVERLASTING Valves...

Take the gamble out of your boiler blow-off!



A driller's job carries enough "headaches" as it is. He can't afford to gamble on the efficiency of his boiler blow-off valves.

As drillers have testified for years, the EVERLASTING name on a blow-off valve means dependable, trouble-free performance under long, hard usage. EVERLASTING's 40 years of experience and valve savvy have produced blow-off valves especially suited to oil-field service. And here's what makes these valves as good as users say they are . . .

- Straight-through blow—no clogging
- A drop-tight seal—maintained by pressure
- Quick action—direct and positive
- Only one moving assembly—post, lever-arm, disc
- Short lever-travel—less than a quarter-turn
- Self-grinding, self-polishing, self-lapping as disc moves across seat—dirt and scale can't lodge under disc
- Tough materials—resisting rust, corrosion, abrasion

These EVERLASTING Blow-off Valves have other good points, but you get the idea — they're *really trouble-free* . . . and tougher than any job you'll give them!

Sold by all leading Oil Field Stores

Fig. 1010-300, Regular EVERLASTING Valve, screw end, rack - and - pinion type, cast steel—equipped with Stellite faced disc—for 300-lb. oil-field boilers.

Fig. 1010-350, Special EVERLASTING Valve, screw end, rack - and - pinion type, cast steel—equipped with Stellite faced disc—for 350-lb. oil-field boilers.

EV-323

Everlasting Valves GIVE "EVERLASTING" SERVICE

EVERLASTING VALVE COMPANY
49 FISK ST., JERSEY CITY 5, N. J.

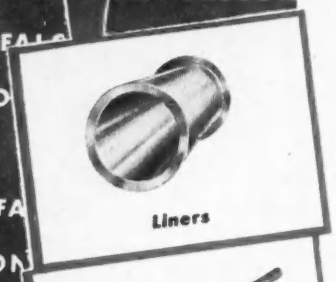
Trade-mark "EVERLASTING"—REG. U. S. PAT. OFF.

Compare FALCON *Quality*

MORE HOURS OF SERVICE IN

FALCON

SLUSH PUMP PARTS



Liners

Piston Rods

Demountable Pistons

FALCON

- Swivel Wash Pipes
- Swing Check Valves
- Trigger Trip Valves
- Safety Throttle Valves
- Installation of Hughes Flash Weld Tool Joints

Quality vs. Price . . .

In dealing with the toughest pumping job on earth – the movement of highly abrasive muds under extremely heavy pressures, FALCON has concentrated its every resource on building pump parts that will outlast all others.

When it comes to price, it's the cost per hour of slush pump operation that counts. COMPARE FALCON PRODUCTS for long-lasting durability. Make your own test right on the job. Install FALCON Liners, Pistons, Rods and Packing on one side of your slush pump. Install identical parts of any other make on the opposite side. After a period of the hardest usage, check the results and make your own comparison.

• Sold only through leading supply houses everywhere.

FALCON PRODUCTS, INC.

POMONA, CALIFORNIA

LOS ANGELES, CALIF. 405 Subway Terminal Building • HOUSTON, TEXAS 1802 Maury Street

Branch Warehouses: ODESSA • WICHITA FALLS • OKLAHOMA CITY

JEANERETTE, LA. • CASPER • RANGELY • BAKERSFIELD & AVENAL, CALIF. • TURNER VALLEY, CAN.

Export Representative: Guy E. Daniels, 30 Rockefeller Plaza, New York 20, N. Y.

Men in the Industry NEWS

Maston Nixon was appointed executive vice president for all operations of Southern Minerals Corporation, Southern Pipe Line Corporation, and Southern Petroleum Corporation. Directors also elected **I. C. Hatridge** as operating vice president of all three companies, **James Doughty** as vice president in charge of production for Southern Minerals, **C. M. Hall,** vice president in charge of land, legal and geological departments of Southern Minerals, **F. P. Peterson, Jr.,** as vice president in charge of engineering for Southern Minerals and Southern Pipe Line, and **Arthur Elliott,** as assistant comptroller of all three companies. All five are located at Corpus Christi.

George S. Engle, oil producer of Mt. Carmel, Ill., has moved his offices to Evansville, Ind.

J. R. (Jack) Less, independent oil producer, now has offices in the Mercantile Bank Building, Dallas. He moved from Fairfield, Ill.

David Dolson was appointed assistant to **D. Y. Hewitt,** general manager of Simrall Corporation. He previously had been connected with the branded sales division of Roosevelt Oil Company for two years, and is replaced in that capacity by **Merle Huggins.**

W. D. Frank of the oil division of Warren Petroleum Corporation has been transferred to the company's Houston office to handle the lease record section. He formerly was at headquarters in Tulsa.

Robert L. Whiting, associate professor of petroleum engineering at Texas A. & M. College, has returned to Bryan, Texas, to continue his teaching work. During the summer he carried on research work in the drilling mud laboratories of the Magnet Cove Barium Company in Houston, where his studies were centered on the problem of lost returns.

Neal W. Schulze, formerly chief engineer at Webster Station, League City, Texas, for Humble Pipe Line Company, has been transferred to the main offices at Houston and promoted to assistant master mechanic.

W. E. Gentry has been promoted to chief engineer for the Webster Station of Humble Pipe Line Company at League City, Texas. He was formerly operating chief engineer at the Hull Station.

Arthur G. Levy, consulting engineer, has opened an office in the West Building, Houston. Levy is former chief engineer of Fohs Oil Company, and previously was with The Texas Company for many years.

Denver Perkins, district attorney at Gonzales, Texas, for the past two years, has joined Cities Service Oil Company with headquarters at Houston.

W. T. Lea, former party chief for Ark-Fuel Company at Magnolia, Ark., has joined Cities Service Oil Company as a seismologist, with headquarters in Houston.

Men in the Industry NEWS

Charles G. Herbruck was appointed assistant secretary of the James F. Lincoln Arc Welding Foundation. He has wide experience in selling, newspaper work, and industrial management.

Edwin A. Wert has been appointed director of sales for the expansion-joint division of Chicago Metal Hose Corporation. His headquarters are in Maywood, Ill.

Walter R. Skinner, representative of the Oil and Petroleum Yearbook published in London, England, is in Houston to talk to oil field equipment manufacturing companies for his publication. His father **Walter E. Skinner,** is editor.

E. R. Douglas has joined The Atlantic Refining Company's Midland, Texas, geological staff, and will work under **Niles D. Winter,** district geologist. Douglas is a graduate geologist of Texas Christian University.

Clarence J. Priegel has joined the staff of **Harry H. Nowlan,** consulting engineer, as a valuation engineer. Nowlan's headquarters are in Evansville, Ill.

Carl Myers, former controller of Tennessee Gas Transmission Company, was elected treasurer of the firm. **W. D. Waiser,** former assistant secretary, was elected secretary. **R. L. McVey** was named comptroller, and **N. W. Freeman** was appointed assistant to the president.

Frank B. Conselman has resigned as Abilene, Texas, district manager for American Trading & Production Corporation to become an independent consulting geologist with offices in Abilene.

T. C. Delbridge, manager of The Atlantic Refining Company's Research and Development Department, has retired after 36 years' service, and is succeeded by **H. W. Field,** formerly assistant manager of the department.

Deaths

James Edwin McClure, 67, retired co-owner of McClure Oil Products Company, died recently in Charleston after a long illness. He retired after selling the business to McJunkin Supply Company of Charleston in 1923.

Laforest John Bodine, 51, head of the Bodine Drilling Company, Great Bend, Kansas, died in Great Bend September 17 of a heart attack. He was a former Tulsa resident, and was a native of Sistersville, W. Va.

William Foot Mitchell, a managing director of Shell Transport and Trading Company before the war and a director of several other Shell companies, died recently.

Robert Frances Donovan, 33, engineer for Bay Petroleum Corporation at Denver, and a former Tulsa resident, was killed September 19 in an automobile accident near Holly, Colo.

Job Aptitude

In thinking about what to say in this first World Oil monthly advertisement, we were a little surprised to remember that we started out in the supply business as a means to an end. We wanted to make money. Now we have grown accustomed to grocery funds and a place to live. The job has become an end in itself. If we have a hobby, this is it. In the beginning we took our advertising—it was in the Oil Weekly then—very seriously. We talked about PELCO bits and fishing tools and intimated that folks should buy 'em. That might have been thirty years ago. Now we'd rather talk about things of more general interest, having learned that success hinges on experience, reputation, friendship and service, along with good merchandise. Call it vocational aptitude. Call it anything you like, but in this business, if you're tops, you come to look on your supplies and equipment as a champion golfer on his favorite clubs or some old music maker on his Stradivarius. You can do more with 'em than anyone else, and you know it. Moreover, your public rightly respects your attitude.

WE'VE SUPPLIED OIL MEN IN OUR AREA FOR 39 YEARS

PELICAN WELL TOOL & SUPPLY CO.

SHREVEPORT LOUISIANA

PELCO

Berwick
New Iberia
Lake Charles

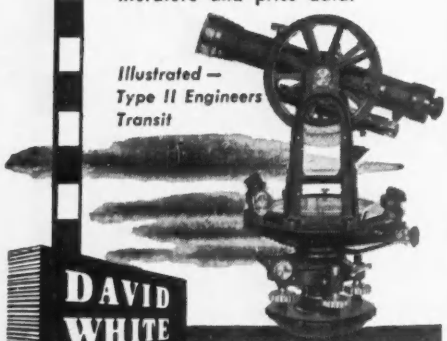
FOR GREATER ACCURACY AND DEPENDABILITY

White

TRANSITS -- LEVELS -- ALIDADES

with coated optics

The recognition accorded White instruments is world-wide — a tribute to the accuracy and dependability for which they have long been famous. Write today for detailed literature and price data.



Illustrated — Type II Engineers Transit

DAVID WHITE COMPANY

313 WEST COURT STREET
MILWAUKEE 12, WISCONSIN

Manufacturers of instruments for engineers, surveyors and builders

Manufacturers' — Suppliers' NOTES

American Steel and Wire Appoints Head of Mid-Continent Rope Sales

B. M. Ashbaucher has been appointed manager, Mid-Continent oil field rope sales, for American Steel & Wire Company, Cleveland.

B. M. Ashbaucher

In his new position, with headquarters in Dallas, he will succeed Edwin T. Eggers, who has been transferred to the general sales department of the company in Cleveland.

Ashbaucher has been associated with American Steel & Wire since 1939, and most recently has been manager of the electrical, wire rope, and construction materials department of the New York City sales office.

Patterson-Ballagh's Office in Alice, Texas, Has New Location

Removal of the Patterson-Ballagh office in Alice, Texas, to the Alice Specialty Warehouse on the Falfurrias highway was announced by Jack P. Magoffin, Mid-Continent manager. H. H. (Bud) Collins, in charge of the office, maintains a full stock of Patterson-Ballagh items at the new location.

Magoffin also announced the employment of W. W. (Dick) Simpson, as city salesman in Houston. After several years of service in the army, Simpson was employed by the Lone Star Cement Company. He will make his headquarters in Houston.

Engineering Staff Additions Made By Brown Instrument Division

Sales and service engineering staff additions and promotions have been announced by the Brown Instrument division of Minneapolis-Honeywell Regulator Company.

Edward B. Kohl has been transferred to Corpus Christi, Texas. He previously was with the Houston branch office of the company.

I. K. Farley has been transferred from the Philadelphia branch office to Houston.

John D. Root, formerly instructor at the Brown School of Instrumentation, has been mades sales engineer at Philadelphia.

E. Curt Richards has been transferred from the company's general sales department to the New York sales engineering staff.

Thomas Pitts has been appointed industrial sales engineer at the Charlotte branch office.

In line with the company's expansion of customer service facilities, it has added the following men to its branch office field service engineering staffs:

William E. Brittain, Philadelphia; Edward J. Chance, New York; Ethron B. Deebel, Philadelphia; Gerald R. Dryden, Syracuse; John W. Forbes, Albany; Carl R. Haug, Philadelphia; Willard A. Holm, New York; Roger F. Lederer, Chicago; Albert J. Leonaitis, Hartford, Conn.; Elgin H. Lochte, Houston; John E. Luttrell, Buffalo; Kenneth Shapleigh, Boston; Clayton K. Taylor, Indianapolis; Robert H. Walker, Cleveland, and Frank M. West, Boston.

West Coast Manager Named for Tube Turns Welding Fittings

Jack Green, sales manager of the Welding Fittings Division of Tube Turns, Inc., Louisville, Ky., has announced the appointment of Lewis M. (Lou) Bound, Jr., as West Coast manager, with headquarters in San Francisco.

Lewis M. Bound, Jr.

Bound joined Tube Turns' New York office sales staff in July 1941. During his three years in the Army, he served in the field artillery in the European Theatre.

Chicago Metal Hose Purchases Fort Dearborn Manufacturing Firm

Chicago Metal Hose Corporation of Maywod and Elgin, Ill., announced the cash purchase of all capital stock of Fort Dearborn Manufacturing Company, Sterling, Ill. The purchase price was not disclosed.

Fort Dearborn Manufacturing Company will be operated as a wholly-owned subsidiary and will continue its services in the field of production machining and as engineers and builders of special machinery, tools, dies and fixtures.

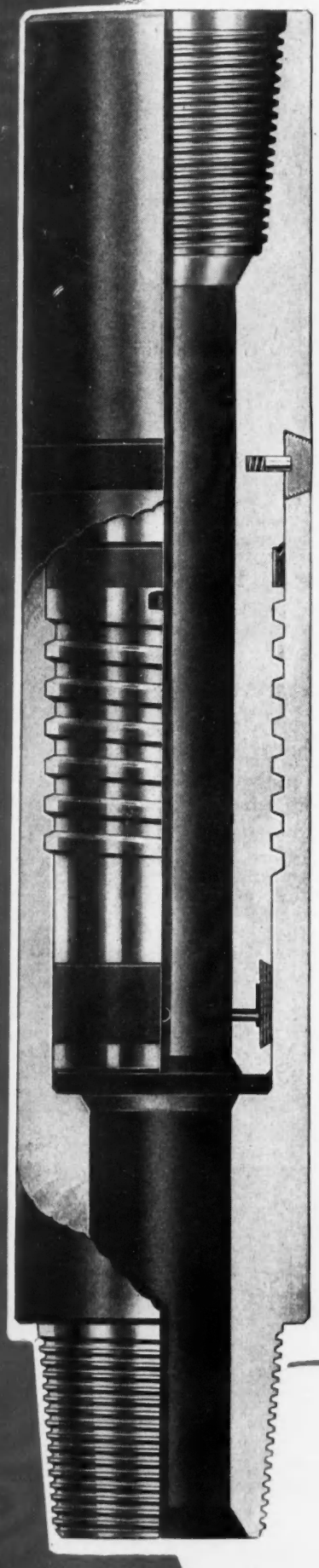
Since the war, Chicago Metal Hose has been developing tooling and equipment for a new line of stainless steel and copper expansion joints for pipe lines. This program has been completed and production space will be made available at Fort Dearborn Manufacturing Company. Additional space there is being made for the greatly expanded production of the regular lines of flexible metal hose which Chicago Metal Hose Corporation has manufactured for many years.

U. S. Rubber Company Announces Changes in Sales Organization

H. Barden Allison has been appointed sales manager of the Gilmer division of U. S. Rubber Company, V-belt manufacturing and distributing unit in Philadelphia. He will be succeeded at Cincinnati by Ralph W. Stambaugh, a salesman in that district.

Other personnel changes in the company's mechanical goods sales organization were announced as follows:

Purdy Miller, district sales manager in Buffalo, appointed district sales manager in Indianapolis, effective October 1; N. W. Swenson will succeed Miller at Buffalo. Paul S. Bigby, assistant district sales manager at Detroit, named district sales manager at Milwaukee, effective immediately.



YOU CAN DEPEND ON TIW SAFETY JOINTS

The absolute reliability of T.I.W. Safety Joints results from these features:

1. **The special non-locking friction ring** takes the heaviest driving loads without wedging. Controlled friction assures positive release—yet prevents backing-off when going into the well. No weight is required to make release.
2. **Pin is chromium plated** to prevent wear and galling.
3. **The double seal** completely protects threads from mud.
4. **T.I.W. Safety Joints** are full opening in all sizes for both drill pipe and tubing.

T.I.W. Safety Joints are used on rotary jars and washover strings. They are also used in coring, cementing, and practically all fishing operations because of their positive release.

TEXAS IRON WORKS

MANUFACTURERS OF: T.I.W. Portable Rigs . . . T.I.W. Safety Joints . . . T.I.W. Rotary and Casing Slips . . . T.I.W. Grief Stem Safety Valves . . . T.I.W. Packers for every purpose . . . and many other oil field tools.

GENERAL OFFICE AND MAIN PLANT: 1401-1423 Maury Street, Houston 10, Texas. Other Shops at Victoria and Corpus Christi.

EXPORT REPRESENTATIVE: Val R. Wittich, 30 Rockefeller Plaza, New York, N. Y.

PAGES 3945 THRU 3964 IN THE COMPOSITE CATALOG

Factory Facilities

for production line method of PICKLING, and the application of AMERCOAT Vinyl Baked Phenolic linings in DRILL PIPE, SALT WATER and CONDENSATE PIPE.

Consult us for rates applicable to all producing areas. Lowered in-transit service rates. Also field service for coating and lining tanks and pipe.

Nowery J. Smith Company

GALVANIZING–AMERCOAT PLASTIC COATINGS – PLATING – STEEL WHSE. STOCKS

Taylor 6111 P. O. Box 7398

Houston 8, Texas

QUICK REPAIRS ON CONDENSER and HEAT EXCHANGERS

If you need condenser or heat exchanger repairs in a *hurry* call us. We specialize in fast, high quality work.

25 Years Successful Experience

GULF ENGINEERING CO., INC.

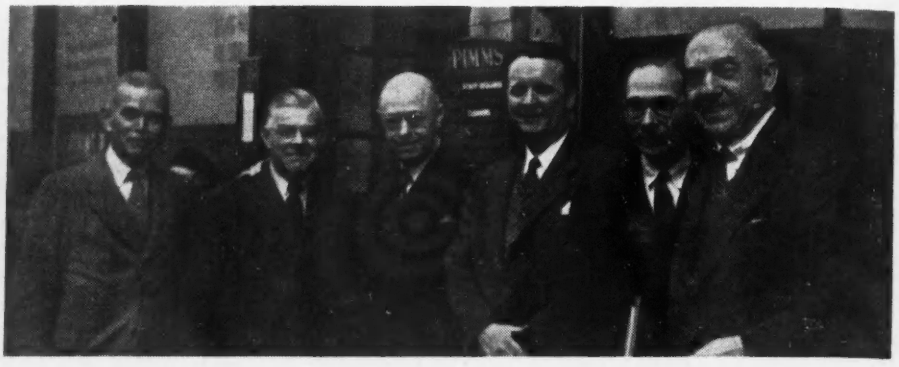
"Service Not Promises"

1682 INGEBORG ST. HOUSTON, TEXAS

916 S. PETERS STREET NEW ORLEANS, LA.

Manufacturers' — Suppliers' NOTES

Manufacturers Meet in London



Representatives of the oil-tool manufacturing and petroleum industries are shown outside Pimm's restaurant in London. Left to right, they are Harold Towler, London representative for Byron Jackson's Patterson-Ballagh Division; W. B. Goldey, Lucey Export Corporation; J. C. Ballagh, vice president of Byron Jackson's Patterson-Ballagh Division; P. Bannerman, Totco Export Company sales manager; H. G. Austin, Iraq Petroleum Company; and Harold Gray, European representative for Reed Roller Bit Company.

Strong Purchases Steam Specialty Division of Ajax Iron Works

Purchase of the Steam Specialty Division of Ajax Iron Works by the Strong Steam Specialty Manufacturing Company, subsidiary of Strong, Carlisle and Hammond Company of Cleveland, was announced by J. H. Castor, general manager of Ajax Iron Works.

This division of Ajax manufactured the Strong line of steam traps and other engineering specialties exclusively for the Cleveland company, which has been marketing them nationally for over 40 years.

Castor stated that the change will enable Ajax Iron Works to concentrate upon the rapidly-increasing production of Ajax Gas Engines, together with the company's regular steam-engine manufacture. He revealed that the extensive Ajax building program, which included new shops, assembly and warehouse facilities, in addition to enlargement of the foundry, is practically completed, and gas engine production in high gear.

Castor also advised that Ajax expects to continue to furnish castings to Strong, Carlisle and Hammond.

Harry Krone, superintendent of the Ajax Steam Specialty Division, will continue with the new owners in charge of manufacturing.

GOTKOOL WATER COOLER
Made in 2, 3, 5, 8, 10, 15 and 20 gallon sizes with Push-Button Faucet.

Gotkool
WATER CANS & COOLERS

GOTT Water Coolers are the convenient way to keep drinking water handy to the worker, protect it from impurities. Their exclusive construction keeps water cool for long periods. Snug fitting large removable top, handy non-leaking push button faucet. GOTT Water Cans for handy field use. Your Supply Store has them, get one today! . . . .

GOTKOOL WATER CAN
Made in 1½, 2, 3, 5, 10, 15 and 20 gallon sizes. (Push Button Faucet at slight additional cost.

H. P. GOTT MFG. CO.
WINFIELD, KANSAS

KEEP PURE DRINKING WATER ALWAYS HANDY

A complete line of
quality petroleum products

GULF OIL CORPORATION
GULF REFINING COMPANY

General Offices, Pittsburgh 30, Pa.

Refineries:

NEW YORK, N. Y.
PHILADELPHIA, PA.
PITTSBURGH, PA.
TOLEDO, O. · CINCINNATI, O.
PORT ARTHUR, TEX.
FORT WORTH, TEX.
SWEETWATER, TEX.

Sales Offices:

BOSTON · NEW YORK
PHILADELPHIA · PITTSBURGH
TOLEDO
LOUISVILLE · ATLANTA
NEW ORLEANS
HOUSTON

Hewitt Rubber Division Names Distributor in West Virginia

Hewitt Rubber Division, Hewitt-Robins Inc., has announced the appointment of the McJunkin Supply Company, Inc., of Charleston, W. Va., as a distributor of the entire Hewitt line of industrial hose, belting and packing.

McJunkin operates branch sales offices and warehouse facilities in Allen, Ky., Hamlin, W. Va., and Marietta, O., in addition to its home office in Charleston, where it maintains sales quarters on the second floor, United Carbon Building. The company also operates its own machine shop and fabricating plant in Charleston.

McJunkin has a sales force of 18 supply men, each with extensive industrial service experience. Company officers include H. B. Wehrle, president; George S. Herscher, vice president, and J. H. West, purchasing agent.

Norris Adds Salesman

John A. Getty has been added to the staff of W. C. Norris Manufacturer, as field salesman in Shreveport, to replace Arthur Miller, who has been transferred to Tulsa as city salesman.

Here it is!

A SHOT AND TEST HOLE BIT THAT CUTS ALL FORMATIONS—HARD AND SOFT—WITH HIGHEST EFFICIENCY

NEW "Rock Cutter" Blades in the Hawthorne Bit adapt it to digging *hard* and *soft* formations with equal efficiency. With these blades in your bit assembly, it's no longer necessary to change bits when you go from a soft to a hard formation, or vice versa.

Blades are designed so that formation is removed in *small* chips, which circulate easily to the surface. There's an absolute minimum of bit area on the bottom, yet, each revolution of the bit removes a full gauge section of the hole.

Hawthorne "Rock Cutter" Blades interchange in regular Bit Assemblies, so there's nothing new to buy. Blade sizes range from 3¾" to 5" for the Type "AC" Assembly; from 3" to 4" for the "DB" Assembly. For highest efficiency, it is recommended that the "DB" Assembly be used with blades 4" and under.

Get the full information on these new, economical bits . . . write for our latest bulletins *today*.

AVAILABLE IN TWO MODELS
Type "AC" for "N" and API Rod;
Type "DB" for "A" and "N" Rod.

Herb J. Hawthorne

P. O. Box 7299 — 5003 North Shepherd
HOUSTON 8, TEXAS

U. S. Steel Advertising Director Retires, Successor Appointed

Charles R. Moffatt, director of advertising of U. S. Steel Corporation of Delaware, retired September 30 after 40 years of continuous service. Moffatt was named advertising manager of the Illinois Steel Company in 1919. When that company was consolidated with Carnegie Steel in 1935, he became advertising manager of the new Carnegie-Illinois Steel Corporation. Three years later, he was appointed the first director of advertising of the U. S. Steel Corporation of Delaware, continuing in that capacity until the present time.

Charles R. Moffatt

G. Reed Schreiner was appointed director of advertising to succeed Moffatt. His 28-year period of service began with his employment by Carnegie Steel Company in 1919. He was advertising manager of Carnegie-Illinois Steel Corporation in 1938, and assistant manager of advertising of the Delaware corporation in 1947, from which position he received his present promotion.

Eutectic Completes Centralization Program in Plant at Manhattan

Eutectic Welding Alloys Corporation has completed centralization of output and research in its Manhattan plant, now capable of turning out 90 special types of welding rods valued at $10 million annually. The new facilities are located at 110 Duane Street.

The buildings house a nonferrous and ferrous foundry, laboratory units for basic welding research, and metallurgical and chemical control and inspection. Production machinery and equipment layout occupies 37,000 square feet, including air-conditioning and dehumidification chambers for rod-flux coating processes. Batteries of electrode extrusion presses, wire drawing tables, infrared drying equipment and baking ovens are laid out for straight-line operation.

The company operates another branch in Lausanne, Switzerland, founded in 1906.

Mack Executive Named

Appointment of John G. Caley as manager of the National Accounts Department for the Southern Division of Mack Trucks was announced by E. G. Ewell, vice president and division manager for Mack.

Caley has had many years of experience in the trucking business. Recently he was connected with the Carley Trailer and Equipment Company of Atlanta, Ga., and during the war he was regional director for the Office of Defense Transportation in the Southeast. Previously he was vice president and general manager of Transportation, Inc., for a number of years.

This Bank offers *Special* Advantages

WHILE this bank's operations are not confined to any one oil district, our familiarity with and accessibility to the Gulf Coast area place us in a prior position to serve those whose operations are in this territory.

Our first-hand knowledge of properties and conditions in this region enables us to pass quickly on projects involving its development. You will find us fully qualified to discuss your plans and make constructive suggestions.

From every standpoint, if you operate in this area, it will be to your interest to consult The Second National Bank of Houston about your financing problems.

CAPITAL AND SURPLUS $10,000,000

THE SECOND NATIONAL BANK OF HOUSTON

MEMBER OF THE FEDERAL DEPOSIT INSURANCE CORP.

LOCATED AT HOUSTON'S CENTER, MAIN AT RUSK

Packing Sales Manager Named For Raybestos-Manhattan

George W. Marshall, Jr., General Sales Manager, Asbestos Products Division, Raybestos-Manhattan, Inc., Manheim, Penn., has anounced the appointment of David E. Gow as Packing Sales manager with headquarters in Manheim.

Gow, who has been with Raybestos-Manhatan, Inc. for a number of years, formerly was branch manager of the Cleveland office of Asbestos Textile & Packing Division. He succeeds Jack E. Cole, who has been transferred to Chicago to take up the duties of Chicago branch manager of the Equipment Sales Division.

Fairbanks, Morse Official Named

James G. Graham has been appointed sales manager of the Railroad Division of Fairbanks, Morse & Company. He joined the organization a year ago as district manager of the Railroad Division, and will continue to have his headquarters in the company's main office in Chicago.

Clark Joins Falcon

H. C. (Whitey) Clark has joined the Falcon Products, Inc., and will supervise sales activities for the company on the West Coast, with headquarters at Los Angeles. He was California sales manager for Abegg and Reinhold Company, and before that was with Crum-Brainard Corporation, Globe Oil Tools Company and Universal Engineering Company. He has 18 years field and sales experience in equipment operation.

H. C. (Whitey) Clark

Mechanical Firm Names Official

Appointment of V. H. McKimmey as sales manager of the Mechanical Manufacturing Company, Inc., of Fort Worth, was announced by Sam P. Hamer, vice president of the company, which manufactures specialized oil field tools.

McKimmey recently has been purchasing agent of the Rowan Drilling Company of Fort Worth and formerly was associated with The National Supply Company and other firms in Texas and Oklahoma in executive capacities.

V. H. McKimmey

Mack Reopens Institute

Following a recess of several months, the Mack Sales Institute resumed its courses in September under the direction of M. C. Horine, head of the Mack Truck Company's Sales Promotion Department. Selected division, branch and dealer salesmen are being brought together from points as far distant as Maine, California, Florida and Oregon for terms of 20 days each at the institute's headquarters in Mack's Allentown, Penn., plant.

Web Wilson Agent Named

E. L. Oliver, formerly a partner in Lewis Manufacturing Company, is now agent for Web Wilson Oil Tools in the Oklahoma territory. He has purchased a warehouse at 1241 Southeast 29th Street, Oklahoma City, where stocks of spare parts as well as complete units are maintained.

Research Department Formed

Black, Sivalls & Bryson, Inc. has set up a department of Market Research and Analysis under the direction of Robert E. Bingham of Kansas City. The department, a part of the Industrial and Public Relations division, will ascertain long range consumer needs, making possible the coordination of production to fit these needs as they arise.

NOW AVAILABLE IN TWO VOLUMES

COMPLETE REFERENCE DATA ON 92 FIELDS In LA., ARK., MISS., ALA.

Here is the most complete set of reference books of its kind ever printed. Petroleum Engineers, Geologists, Geophysicists and Executives will find them invaluable. In a nut-shell here is what you can expect to find:

MAPS . . . include a structural contour and ownership map of almost every field.

SECTIONS . . . Authentic Structural or Columnar Section is shown of each area.

DATA . . . for each field includes History; Development; Producing Zones; Discovery Well Data; Production Data; Pipe Line Connections.

Volume I, 316 Pages.....$12.50
Volume II, 224 Pages.....$10.00
BOTH Volumes ONLY.....$22.50

(All Prices Prepaid)

Order Your Set-TODAY!

Make Check or Money Order Payable to

SHREVEPORT GEOLOGICAL SOCIETY
Box 750 Shreveport, Louisiana

OIL AND GAS FIELDS COVERED

VOLUME I

ALABAMA	LA. (Cont'd)
Gilbertown	Little Creek
ARKANSAS	Logansport
Atlanta	Lucky
Big Creek	Nebo
Buckner	North Lisbon
Calhoun	North Nebo
Columbia	Olla
East Schuler	Ruston
Fouke	Sibley
Hillsboro	Sligo
Lewisville	Simmsboro
Magnolia	South Olla
McKamie	Spider
Mt. Holly	Sugar Creek
Nick Springs	Tremont
Salem Church	Trout Creek
Schuler	Vixen
Stamps	Willow Lake
Texarkana	MISSISSIPPI
Troy	Baxterville
West Atlanta	Brookhaven
LOUISIANA	Carthage Point
Ada	Cary
Bear Creek	Cranfield
Lake Bistineau	Eucutta
Calvin	Fayette
Catahoula Lake	Flora
Chatham	Gwinville
Cypress Bayou	Heidelberg
Haynesville	Hub
Hico	Langsdale
Holly	Mallalieu
Holly Ridge	Pickens
Indian Bayou	Tinsley
Lisbon	Soso

Four triple size Stratigraphic Sections

VOLUME II

ARKANSAS	LA. (Cont'd)
Dorcheat	Big Creek
Gum Creek	Big Island
Macedonia	Choudrant
Midway	Cotton Valley
New London	Delhi
Stephens-Smart	Driscoll
Urbana	E. Haynesville
Village	Elm Ridge
Wesson	Lake Larto
LOUISIANA	Lake St. John
Ashland	Manifest
Athens	Sailes
Beekman	Standard
Benton	W. Delhi

Fourteen triple size Stratigraphic Sections

For straighter holes

CP DRILL COLLARS

CP **DRILL COLLARS** keep the drill stem straight . . . furnish weight to give the bit a better "bite" . . . lengthen life of drill pipe and tool joints.

Made of high-strength alloy steel, they are bored from one end only to avoid offsets, and vertically quenched for their entire length for controlled hardness, and to insure straightness and freedom from distortion strains.

CP **DRILL COLLARS** are notable for their hardness, straightness, concentricity and accurately machined connections.

CP **DRILL COLLARS** are available in 30 foot lengths, in popular sizes, from stock in Oklahoma City, Oklahoma; Casper, Wyoming; Midland, Texas; and our Eastern warehouse. Write for data.

CHICAGO PNEUMATIC TOOL COMPANY

MANUFACTURED AT FRANKLIN, PA.

GENERAL & EXPORT OFFICES: 6 EAST 44th STREET, NEW YORK 17, N. Y.

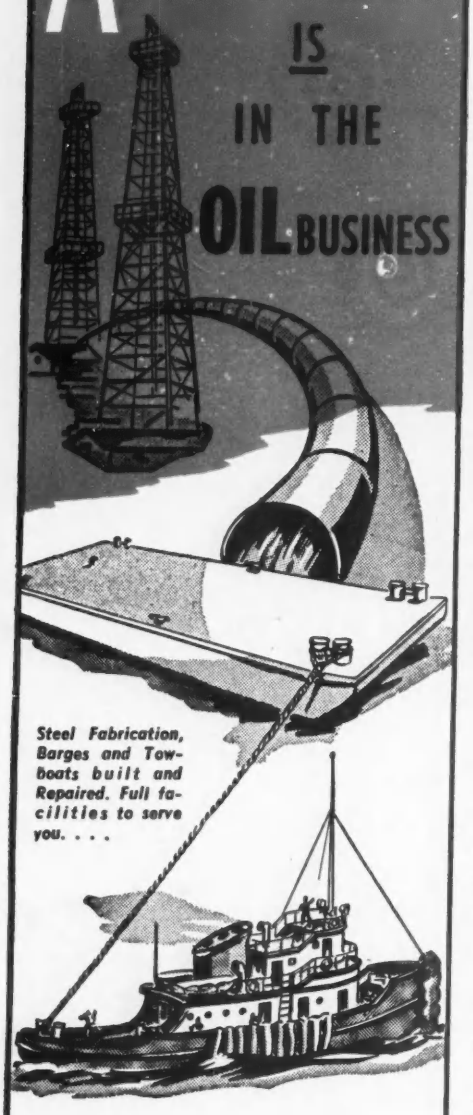
Oil Tool Sales Office: One N. W. 16th Street, Oklahoma City, Oklahoma

AVONDALE

IS

IN THE

OIL BUSINESS



Steel Fabrication, Barges and Towboats built and Repaired. Full facilities to serve you. . . .

AVONDALE'S 2 BIG YARDS — (Quick Repair Plant at Harvey, La., and Main Plant at Avondale, La.) both are near to you by swift water routes. Call AVONDALE on your next job. Write for details!

AVONDALE MARINE WAYS, INC.

River Front, New Orleans Dist.

Telephones: WAlnut 8970—CHestnut 5853

Mailing Address: Westwego, Louisiana

Manufacturers'—Suppliers' NOTES

Guiberson Representative Named To Sales Position in Houston

Robert S. (Bob) Warren has joined Guiberson Corporation of Dallas, manufacturers of oil field equipment, as Houston district sales representative.

R. S. Warren

For the past nine years Warren was with Thornhill-Carver as Houston sales representative, and prior to that was associated with Mid-Continent Supply Company.

According to Al Pranger, Guiberson general sales manager, W. D. Koons, sales and service representative in the Houston office of the company for the past year, will remain in his present capacity.

Lieut. Gen. Ira C. Eaker Becomes Vice President of Hughes Tool

Lieut. Gen. Ira C. Eaker, World War II commander of all allied air forces in the Mediterranean theater, has joined Hughes Tool Company, Houston, as a vice president and assistant to Noah Dietrich, executive vice president.

Eaker's specific duties were not described by Dietrich, who said the appointment was made because "We are always looking for good men, and when we heard the general was retiring, naturally we asked him to work for us."

Eaker, 51, is a native of Field Creek, Llano County, Texas.

President of Four Wheel Drive Auto Company Reelected for 38th Time

Walter A. Olen was reelected president of the Four Wheel Drive Auto Company for the 38th time at the annual meeting of the board of directors.

Other officers elected were Joseph D. Cotton, vice president; Donald S. DeWitt, vice president; D. J. Rohrer, vice president; R. H. Schmidt, vice president in charge of sales; Robert A. Olen, general manager; S. H. Sanford, secretary; Helen Weller, assistant secretary; J. A. Driessen, treasurer; and G. F. Richardson, assistant treasurer.

Baker Official on Tour

Henry W. Pullman, export manager of Baker Oil Tools, Inc., Los Angeles, is on an extended business trip in Europe and the Middle East. Leaving New York August 14, he expected to visit oil company offices in London, The Hague, Paris, Cairo and various points in the oil-producing areas of Saudi Arabia. He will return to Los Angeles on December 23.

Union Tank Manager Chosen

Jack A. Deaver has been appointed new state manager for Louisiana by Union Tank and Supply Company. He will work out of the branch office at Lafayette, and handle sales and distribution. He was formerly drilling, production and field superintendent in oil fields in South Texas, the Gulf Coast and Louisiana, and has been with major and independent oil companies.

WATER
Wastes Fuel

when scale and corrosion clog boiler tubes. Equipment life is shortened, efficiency impaired.

You Don't Need

to put up with it. Regardless of water or operating conditions, with no need of water analyses,

SAND-BANUM

safely and automatically removes and prevents boiler scale and corrosion while your equipment operates.

MAKE YOUR OWN TEST AND KNOW

Write for Details Today

"The Entirely Different Boiler and Engine Treatment

AMERICAN SAND-BANUM COMPANY, Inc

9 ROCKEFELLER PLAZA

NEW YORK CITY

DURBIN-DURCO, Inc.

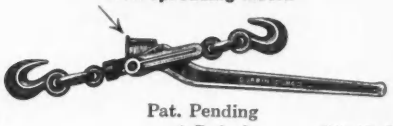
Manufacturers Certified Specialty Products

Malleable Iron • Drop-Forged • Steel

LOAD BINDER — MALLEABLE IRON

Heat Treated • 5 Sizes

With New, Improved, Reinforced Non-Spreading Mouth



Pat. Pending

		1 Swivel	Wt. Each
MIDGET	No. 1—	¼" chain	2¼ lbs.
DELTA	No. 1—	5/16 or ⅜" chain	6½ lbs.
		Two Swivels	Wt. Each
DIXIE	No. 1—	7/16 or ½" chain	10 lbs.
LONE STAR	1—	7/16, ½ or 5/8" chain	14 lbs.
LONE STAR	2—	7/16, ½ or 5/8" chain	17 lbs.

LOAD BINDER — DROP-FORGED

Heat Treated • 2 Sizes

Two Swivels

Durbin-Boomer F-1—for ⅜", chain . . . . . 10 lbs.

Durbin-Boomer F-2—7/16, ½ or 5/8" chain . 12 lbs.

Other Durbin-Durco Products

COMBINATION ROPE HOIST AND WIRE STRETCHER • Extra Heavy Duty

ALL-STEEL ROLLER BEARING, ROPE HOIST

WOVEN WIRE FENCE STRETCHER

Lever Action, Double Ratchet, Also Worm Gear Type

WRITE FOR CATALOG • Dept. WO

DURBIN-DURCO, Inc.

6611 Olive St. Road • St. Louis 5, Mo.

4-CYCLE GAS-ENGINE COMPRESSORS

Six 800-hp Type KVG gas-engine-driven compressors on recycling service.

4-Cycle DEPENDABILITY
" " LOAD FLEXIBILITY
" " FUEL ECONOMY
" " LUBE-OIL ECONOMY
" " SIMPLICITY
" " CONSERVATIVE RATING

Whether the load is heavy and continuous . . . whether the pressures are steady, variable, or surging . . . whether the required speed is constant or fluctuating.

You get these advantages in Ingersoll-Rand Gas Engines and Gas-Engine Compressors . . . Sizes 75 to 1200 horsepower

Ingersoll-Rand

11 Broadway, New York 4, N. Y.

78-6

Personnel Appointments Announced By International Derrick Company

W. L. Reynolds was appointed manager of purchasing and stock control, Supply Stores Division of International Derrick & Equipment Company in Dallas, and Albert Ditson was appointed purchasing agent for the division there.

Reynolds has been with Ideco since 1941 and previously was purchasing agent of the division, which comparable position he also held with Bridgeport Machinery Company before joining Ideco. Ditson formerly was with the Petroleum Administration for War in Washington, in the Foreign Materials Section, and before that was general purchasing agent for oil field supplies in Wichita, Kansas.

Ernest H. Polliet was made purchasing agent for Ideco at Marietta, Ohio. For the prior six years he has been assistant purchasing agent for a major manufacturer in Marion, Ohio.

All American Industries Acquires Capital Stock of A. D. Cook Firm

All American Industries, Inc., has acquired the outstanding capital stock of A. D. Cook, Inc., of Lawrenceburg, Ind.

The Cook company manufactures deep-well steam-driven pumps, plunger pumps, and turbine motor-driven pumps, shallow-well pumps, well supplies, and compression type fire hydrants.

This is the third acquisition in allied fields by All American Industries, Inc., during the current year, it having previously acquired Oklahoma Steel Castings Company of Tulsa, Oklahoma, producers of steel castings, and The Fitz-Simons Steel Company of Youngstown, Ohio, producers of cold drawn steel bars.

In connection with the Cook, acquisition, it was explained by Robert C. Hardy, president of All American Industries, Inc., that Cornelius O'Brien, who has been president of that company for a number of years, will continue in an active capacity as chairman of the board, and that all other key personnel will be retained.

HUBER
PARAFFIN
SCRAPERS
MAKE YOUR SUCKER RODS YOUR PARAFFIN SCRAPER
Why bother with paraffin accumulation and the cost of steaming out or "passing rods" to free your wells of paraffin.
Huber Scrapers attached to the sucker rods, constantly scrape the paraffin from the tubing as the rods reciprocate and rotate. A patented rotating rod hanger gives the string a fraction of a turn on each stroke. And with the scrapers clearing the tubing by only a fraction of an inch, paraffin is wiped off the tubing and pumped out of the well before it can accumulate on the tubing.
Make your sucker rod string your paraffin scraper by equipping it with Huber Scrapers.
ORDER FROM YOUR SUPPLY STORE
they scrape while they rotate and reciprocate.
require no servicing or attention.
soon pay for themselves by saving work-over costs.
hundreds of users report outstanding success of their operation.
HUBER
PARAFFIN SCRAPERS
J. M. HUBER CORPORATION
BOX 831
BORGER, TEXAS

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912, AS AMENDED BY THE ACTS OF MARCH 3, 1933, AND JULY 2, 1946

Of WORLD OIL (Formerly—The Oil Weekly) published Weekly (*) at Houston, Texas, for October 1, 1947.

State of Texas, County of Harris, ss:

Before me, a Notary Public in and for the State and County aforesaid, personally appeared A. L. Burns, who, having been duly sworn according to law, deposes and says that he is the Business Manager of WORLD OIL and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily, weekly, semiweekly or triweekly newspaper, the circulation) etc., of the aforesaid publication for the date shown in the above caption, required by the act of August 24, 1912, as amended by the acts of March 3, 1933, and July 2, 1946 (section 537, Postal Laws and Regulations), printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, Ray L. Dudley, 3371 Chevy Chase, Houston, Texas; Editor, Warren L. Baker, 1613 Woodhead, Houston, Texas; Business Manager, A. L. Burns, No. 7 Chelsea Place, Houston, Texas.

2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one percent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.)

The Gulf Publishing Company, Houston, Texas; James Anderson, Houston, Texas; A. L. Burns, Houston, Texas; James F. Carter, Jr., Tulsa, Okla.; Mrs. Mary Margaret Cashman, Houston, Texas; Mrs. Carolyn Dodson Dudley, San Angelo, Texas; Mrs. June Wooden Dudley, Trustee, Princeton, N. J.; Dr. N. L. Dudley Deceased, Houston, Texas; Ray L. Dudley, Houston, Texas; Wm. G. Dudley, Houston, Texas; Mrs. Libbie Rice Farish, Houston, Texas; Mrs. Wm. V. Gross, Utopia, Texas; Mrs. Anita S. Lane, Houston, Texas; Chas. H. Lane, Houston, Texas; Tom W. Nelson, Houston, Texas; Mrs. Maude G. Sterling, La Porte, Texas; O. R. Waller, Chicago, Ill.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the twelve months preceding the date shown above is 16,066. (This information is required from daily, weekly, semiweekly, and triweekly newspapers only.)

A. L. BURNS, Business Manager.

Sworn to and subscribed before me this 17th day of September, 1947.

P. J. AUCOIN.

(Seal) Notary Public in and for Harris County, Texas
(My commission expires June 1, 1949.)

(*) This publication will be made a monthly beginning October 1st, 1947.